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The Macro Economic Factors affecting Property Prices in Malta
Luke Vella ................................................................. 4

How Effective is Apprenticeship to Learning?
A Student Perspective
Martina C. Vella ........................................................ 28

The Effect of Consumer Characteristics and Behaviour on Pork Consumption in Malta. A Quantitative Study
Joseph J. Abela .......................................................... 44

The Attitudes of Maltese Consumers towards Renewable Energy: An Investigation
Carmelina Frendo ...................................................... 59

A Coach’s Perception: Major Factors influencing Late Goal-Scoring Patterns in Maltese Football
Kenneth Costantino ................................................. 68

Typing Biometrics as a Form of Passive User Authentication
Darren Cilia, Frankie Inguanez ................................. 87

The Impact on Education of Children Admitted in Care after Experiencing Abuse
Neil Zammit, Charlotte Moore ................................. 97

Malta’s Higher Education Dimension: Analysing the Extent of Complexity in Change
Colin Borg ................................................................. 114

An Evaluation of the Implications of Thermography within the Healthcare Setting
Cassandra Sturgeon .................................................. 132
The Macro Economic Factors affecting Property Prices in Malta

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Abstract: Property prices have been on top of European governments’ agenda for decades as their contribution towards the whole economic system is imperative. Property prices in Malta have been on an upward trend and, lately, the upward trend has been larger than in previous years. Even though this is a sign of a strong and growing economy, it can have implications on residents due to affordability issues affecting their standard of living. This study seeks to determine the factors which have an influence on property price in Malta whilst also analysing the strength of the relationship each factor holds on house prices. This study examines the Gross Domestic Product, unemployment rate, population, inflation, the number of home loans within the Maltese economy, ageing population, the number of tourists, minimum wage, and development permits. Out of these nine variables tested, eight proved to be statistically significant. The variables which had the largest effect on house prices was the unemployment rate whilst the variable with the least effect on house prices was inflation.

Keywords: House prices; macroeconomics variables; affordability; government

The Local Scenario

In Malta, the property market is a major driver for GDP growth and a very important aspect of investment and savings for many people. Property is a source of bequest helping intergeneration transfers which can only keep on happening if people are able to purchase property and transfer it to cash with minimal hiccups. A healthy, well-functioning, and growing property sector tops the agendas of many European governments. The local housing market is a major contributor towards the stability of the financial system; it is imperative that it functions adequately as any instability can have adverse effects within the whole economic system owing to strong linkages with other sectors (Vella 2016).

High prices are evident in the data which has been put together for this study; in fact it has been argued that local property prices are overinflated due to inexperienced developers (Times of Malta 2009). Over the past two decades the Maltese economy has experienced economic growth and, needless to say, this brought development and urban growth. The population has also increased significantly which further increases pressure on demands for housing.

In a meeting with the Malta Chamber of Commerce in October 2017, Dr Gordon Cordina, director at ECUBED Consultants, stated that 18% of the property on the market is vacant and this gives rise to an issue of the basic demand-and-supply rules. Even though supply might be increasing, given the constant development, the prices of property are increasing still.
The population has also increased significantly which further increases pressure on demands for housing.

In a meeting with the Malta Chamber of Commerce in October 2017, Dr Gordon Cordina, director at ECUBED Consultants, stated that 18% of the property on the market is vacant and this gives rise to an issue of the basic demand-and-supply rules. Even though supply might be increasing, given the constant development, the prices of property are increasing still.

Figure 1 shows that the average year-on-year increase in property prices from 2002 to 2013 was 5.8%; however, from 2013 to 2016 the average increase in property prices grew to 15.3%.

Developments within the housing market are important for the assessment of the overall business system. The housing sector affects the business cycle. Firstly, house prices will affect consumption of households since housing wealth accounts for around 60% of the total household wealth in the euro area. Secondly, developments within real estate affects housing investment and the construction industry which has a significant multiplier effect (Cassar 2015). Finally, put together, these channels tend to be reinforced via the financial accelerator effect; since real estate acts as collateral, it in turn affects the banks' balance sheet and their willingness and ability to provide credit to the real economy (Bernanke et al. 1999; Iacovello 2005).

**Research Objective**

This study aims to assess the macro economic factors which affect local property prices using the Pearson Correlation Coefficient. Furthermore, it will not only identify the factors but also determine the strength of these factors in affecting property prices.

The motivating factor for choosing this topic lay within the importance of certain variables, such as low unemployment rates and high GDP levels which are all positive signs that an economy is doing well. However, do these factors contribute towards higher property prices? And, if so, are they collectively contributing to decreasing affordability within the local property market amongst residents?

The research questions being study are:

i. Which are the macro-economic factors that affect property prices in Malta?

ii. What is the influence of each macro-economic factor on changes in local property prices?
iii. Which macro-economic factor has the largest effect on changes in local property prices?

**Purpose Statement**

The scope of this time-series study is to develop an understanding of which macro-economic factors affect property prices in Malta through the conceptual framework illustrated in Figure 3 and their contribution towards changes in prices. At this stage in the research, the macro economic factors will be defined as those factors which individual institutions do not have control over but are a function of the economic system and government. The framework relates a series of macro factors (independent variables) to property prices (dependent variable) and examines the relationship between the sets using Pearson’s Correlation Coefficient. The sample size which was used for this study covers a 12-year period: 2006–17. The audience for this research are local policy-makers, the finance ministry in charge of schemes promoting sustainable property prices in Malta, along with other institutions affecting the macro economic variables in this study.

**Literature Review**

The study is based on various sources of literature discussed hereunder which are illustrated in Figure 2 through the use of a literature map.
Macroeconomic Factors affecting Property Prices

House prices are usually modelled in terms of changes in demand and supply within the property market (HM Treasury 2003). On the demand side, key factors include income, the real rate of interest rates on home loans, along with financial wealth and demographic factors, such as the labour market conditions. The supply side of housing includes costs of construction, development permits, and other factors, such as material costs. When the housing market is in equilibrium it implies that demand and supply are at par; however, data and various studies shows that the housing market is far from an equilibrium position in nearly every country (Hizmo 2010; Leun 2014; Piskorski and Tchistyi 2017). Renigier-Bilozor and Wisniewski (2012) found that multiple macro-economic factors affect property prices in Europe. In Italy, the macro economic factors affecting house price include final consumption expenditure, the price of water and electricity, and the net national income. Furthermore, Renigier-Bilozor and Wisniewski conclude that, in Poland, employment levels and population growth are major contributors towards house pricing.

GDP

Literature is rich when it comes to the relationship between GDP and the housing market. A study in the USA carried out by Mikhed and Zemick (2009) found that a decrease in the GDP levels had a negative effect on house prices. Complementing this finding was a study by Adams and Fuss (2010) which discovered that the higher the GDP growth, the higher the increase in house prices. Furthermore, various studies agree that GDP does have an effect on the short-run prices (Davis and Heathcote 2003; Goodhart and Hofmann 2008; Madsen 2012). However, contrary to the above literature, Madsen (2012) discovered that such a relationship does not hold in the long run. Finally Égert and Mihaljek (2007), who assessed whether GDP is a determinant of house prices in Eastern European countries, concluded that a significant and positive relationship existed in all the three different model specifications that they utilized.

Unemployment Rate and Population Growth

Renigier-Biłozor and Wisniewski (2012) realize that the unemployment rate influences the level of house prices. They conclude that, since Poland could be considered a developing country, unemployment rate influences the demand for property and this is reflected in the price levels. Furthermore, they posit that, in the case of Poland, population growth is a factor which gives further rise to property prices. Geerolf and Grjebine (2014) discovered that, if unemployment falls by 3.4%, property prices appreciate by approximately 10%. This study was carried out across 43 countries for the period 1970–2010. Moreover, Myrnmo (2012) suggests that an increase in the population does influence house prices through the indirect effect of an increase in demand since an increase in population transcribes to more individuals demanding places to live in, generating higher demand and, finally, higher prices.

Inflation

The theory behind as to why inflation affects house prices is described by Zhu (2004). The mechanism of how it influences house prices lies because housing is viewed as an investment and could be utilized as a good hedge against inflation. This implies that that when inflation is high or expected to increase individuals will demand property as they speculate that the price of the purchased property will increase in the near future. However, as described by Zhu, this will in turn increase property prices further,
a self-fulfilling prophecy. Pillaiyan (2015) suggests that the Malaysian housing prices were significantly affected by inflation but Tze (2013) finds no significant relationship between inflation and house prices in Malaysia. The reason a significant result was no found might be the period of study, which was much shorter.

**Interest Rates and Home Loans**

The Gordon Growth Model can be reinterpreted as a house price model whereby house prices become a function of rent, interest rates, and rental growth implying a convex relationship between house prices and interest rates; the lower the interest rates the greater house price elasticity is to a change in interest rates. In simple terms, the lower the interest rates the higher the percentage increase in house prices (Campbell et al 2006).

Zhu (2004) posits that there is a negative and significant relationship between interest rates and house prices. House prices rise when interest rates drop since most of the purchases are done on credit. This is further enhanced by Barakova et al. (2003) who discovers that, since interest rates are low, affordability increases and so does the demand for housing, resulting in an upward push in house prices as well. This implicitly implies that, as interest rates fall, the number of home loans increase which will further increase the price of property. A study in America carried out by Jorda et al (2015) theorizes that higher interest rates make borrowing more expensive resulting in potential borrowers not bidding up house prices leading to a fall in property prices. Similarly, La Cava (2016) postulates that an increase in house ownership is related to lower interest rates, implying that low interest rates stimulate potential buyers to demand property which will result in an increase in price. A similar study carried out by Mayer and Hubbard (2008) in Spain finds that interest rates also affects property prices positively. Egert and Mihaljek (2007) found a strong and significant effect that the amount of credit to the housing industry has on property prices in central eastern European and OECD countries. They also tested the relationship between house prices and the real interest rate and discovered a negative relationship, implying that lower interest rates will increase house prices.

**Ageing Population**

Several countries, including Malta, are experiencing a new demographic trend called population ageing which can significantly impact house prices. As population ageing becomes more apparent over time, the literature on demographics and housing is continuously expanding. Mankiw and Weil (1989) explain the drastic change in housing demand and found that an ageing population will put downward pressure on house prices. However, not all studies agree with this view; in fact, Pitkin and Myers (1994), utilizing a cohort linked cross-section analysis, showed that housing consumption increases past the age of 70 which results in upward pressure to house prices. Ermisch (1994) discussed how changes in demand for housing is experienced with ageing population because of changes in their needs, mainly downsizing.

**Tourists**

Tourism is one of the most important economic activities for small island states, such as Malta (Briguglio 2008). Both Brueckner (2003) and Shiller (2007) conclude that both air travel and tourism stimulate the development of the local economy which includes the property market and its prices. Similarly Biagi (2015), who assessed whether tourism affected house prices in Italy utilizing a Generalized Method of
Moments approach and a data set of 103 Italian cities between 1996 and 2007, found that tourism affects house prices positively. Literature on tourism and property prices is rather limited as many studies have focused on the relationship between tourism and related accommodation such as hotels and holiday homes (Le Goffe 2000; Fleischer and Tchetchik 2005; Taylor and Smith 2000; Nelson 2009, Vanslembrouck et al. 2005).

Minimum Wage

Income has a great impact on house prices (Li 2008). Housing can be considered a durable good which holds intrinsic value and, as income increases, this results in a stimulus for people to improve their living conditions along with climbing the social ladder; further increased demand for property subsequently results in higher prices. Gan and Hill (2018) found a significant and strong relationship between income and house prices in Sydney, Houston, and the State of Texas. This implies that, as income levels increase, the prices of property will increase as well.

Development Permits

House prices tend to respond to changes in the costs of raw material and labour required. Grimes et al. (2013) show that supply tends to be slow to respond to supply shocks in New Zealand but it is much more responsive in small islands. Development permits and their associated costs can be considered as a supply factor owing to the costs they entail. If the costs of development increases, costs for construction increase and so will property prices.

The Conceptual Framework

The literature discussed in previous sections provides ground to extract a conceptual framework. The purpose is not actually to validate what has been found, but is a bid to expand upon the understanding whether the macro economic factors affecting property prices in different countries affect prices also in Malta. Kelle (2005) and Reichertz (2010) advocate that research should be carried out through the extensive use of literature whilst encouraging new insight without creating any bias. Figure 3 depicts the conceptual framework developed for this study. Based on previous studies, this study assesses whether a relationship exists between the dependent variable being property prices and each independent variable. Moreover, the strength of this relationship will also be assessed through the use of statistical tools.
Figure 3. Conceptual Framework
Methodology

Methodology utilized

Research can utilize several tools and methods to assess the research question being investigated. This section described the methods specifically utilized for this study.

The data collected is both reliable and valid since the sources are reputable institutions. Pearson’s Correlation Coefficient, or Pearson’s R, was developed by Karl Pearson (1948). In addition to being the first test for correlation, it is also the most commonly used measure of association and all subsequent correlation methods stem from Pearson’s equation. Pearson’s Correlation Coefficient measures the strength, direction, and probability of linear association between two interval or ratio variables. The main purpose that many studies utilize such an approach to test correlation is due to the simplicity of applying the test whilst providing other specification or semi-partial and partial correlation (Puth et al. 2014). Golob et al (2012), which assessed the factors affecting the real estate market in Slovenia, utilised the Pearson Correlation Coefficient is to assess such relationship. Similarly, a study in the USA by Valadez (2011) utilized a similar methodology to assess how GDP is correlated to the housing bubble. Quantitative research will be utilized to analyse the relationship between the various explanatory variables and the variable of interest. Based on existing literature, various factors exist which affect house prices and these were taken into consideration and analysed. Creswell (2008) defined quantitative research as means to test objective theories by examining the relationship between different variables.

Data Description

The literature, which provided a solid foundation of various factors which can affect house prices, was based on both EU and non-EU countries. These factors where then taken into consideration and applied to the local scenario to analyse whether such a relationship exists along with the strength of the said relationship.

The Dependent Variable

The variable which was investigated is the property price index for Malta over a 12-year period between 2006 and 2017. The dependent variable is assumed to be explained by various other variables which help to explain changes in the index. The list of variables included in this study are in no way exhaustive in nature and omitted variables might also explain changes in the price. However, the variables included for this research are the ones which are commonly used in studies based on the literature and for which data was available.

The Macroeconomic Factors

Based on the literature available, several macroeconomic factors were chosen to help analyse their relationship with property prices in Malta. In this section a priori expectations of the relationships will be given.

Based on previous studies, the Gross Domestic Product affects the price of property considerably. The variable measuring Gross Domestic Product was obtained from the Central Bank of Malta and is denoted in millions and based on current market prices. Tourism is considered to be another macroeconomic variable which affects property prices. As a norm Malta is accustomed to tourists visiting Malta. Various
sources of literature state that tourists have a positive impact on property prices, implying that their presence increases prices. The data for tourism was collected from the statistics published by the Central Bank of Malta and tourists of every nationality were included. The data gathered was in terms of thousands of tourists. Another important macroeconomic factor affecting property prices is the unemployment rate. Findings in the literature show that a high unemployment rate distorts the value of property since it leads to high crime rates and undesirable living conditions (Melick 2003). Based on previous literature, the expected relationship is a negative one. The data gathered was obtained through published statistics from the National Statistics Office while the data utilized was gathered from the Labour Force Survey. Development permits is another variable mentioned in the literature. For this study, data was gathered from the Central Bank of Malta; the data was not segregated and included various development permits and were not limited to residential property only. Based on previous studies, the expected relationship is positive, implying that, as development permits increase, the price of property should increase too. The number of loans in an economy were also considered as part of the macroeconomic variables. The amount of loans provided by local financial institutions with respect to property is another important variable which is be tested in this study. The data for such loans was gathered from the Central Bank of Malta. The data is in the form of a percentage of the total amount of loans in the economy.

Based on previous studies, inflation is another important variable which contributes to changes within property prices. The data for inflation was gathered from the Central Bank of Malta and was the Harmonized Index for consumer-based prices at current market prices. A priori inflation is expected to positively affect house prices. Population is another variable which affects house prices since, as the population increases, the demand for housing will increase and therefore an increase in prices is expected. The data for population in Malta was gathered from Eurostat. Another important factor identified from the literature is the minimum wage, the data for which was gathered from Eurostat. Changes in minimum wage represent changes in all other wages making it a good representation of all the changes in wages in an economy. The expected relationship is positive. Finally, a few sources of literature include ageing population as a variable which should affect house prices. For this study data was collated from Eurostat and is in the form of a percentage of the total population.

**Data Sources and Analysis**

The macroeconomic variables utilized in this study were gathered through the secondary data published by reputable sources such as the Central Bank of Malta, the National Statistics Office, and Eurostat. The data collected was analysed through two main statistical programmes which include IBM SPSS statistics and Microsoft Excel. IBM SPSS statistics was utilized namely to conduct the Pearson Correlation Coefficient statistic, whilst Microsoft Excel was utilised to present the data gathered in a visual format by utilizing graphical analysis.

The Pearson Correlation Coefficient is a ratio of the covariance of two variances which provides a relationship between the variables under investigation which are of a continuous type. It measures the existence and strength of a linear relationship between two variables and, if the results are significant a correlation, can be said to exist. According to Cohen (1988), an absolute value of r of 0.1 is classified as small, an absolute value of 0.3 is classified as medium, and one of 0.5 is classified as large. The Pearson Correlation test does not show whether a causal link between the variables exists, but only whether such a relationship exists.
The data gathered from various sources was put together as depicted in Figure 4. To ensure that the data can be utilized adequately for this study, it had a common underlying factor which was years which allowed for the comparative analysis to be undertaken within this study.

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP in € Millions (current market prices)</th>
<th>Tourism (thousands)</th>
<th>Unemployment Rate (total)</th>
<th>Total Development Permits, commercial, social and other Permits</th>
<th>Loans to construction and real estate (% of total loans)</th>
<th>Annual Average Index (HICP (2015=100))</th>
<th>Population (thousands)</th>
<th>Minimum Wage (€)</th>
<th>Population aged 65+ (% of total population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1124.24</td>
<td>1177.0</td>
<td>4.8</td>
<td>4.0</td>
<td>4.8</td>
<td>4.8</td>
<td>4.0</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>2007</td>
<td>1243.51</td>
<td>1289.4</td>
<td>4.3</td>
<td>4.0</td>
<td>4.3</td>
<td>4.3</td>
<td>4.0</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>2008</td>
<td>1290.94</td>
<td>174.1</td>
<td>4.0</td>
<td>2.94</td>
<td>2.94</td>
<td>2.94</td>
<td>2.94</td>
<td>2.94</td>
<td>2.94</td>
</tr>
<tr>
<td>2009</td>
<td>1182.49</td>
<td>165.3</td>
<td>4.8</td>
<td>2.69</td>
<td>2.69</td>
<td>2.69</td>
<td>2.69</td>
<td>2.69</td>
<td>2.69</td>
</tr>
<tr>
<td>2010</td>
<td>1340.31</td>
<td>167.1</td>
<td>4.5</td>
<td>2.35</td>
<td>2.35</td>
<td>2.35</td>
<td>2.35</td>
<td>2.35</td>
<td>2.35</td>
</tr>
<tr>
<td>2011</td>
<td>1415.00</td>
<td>169.3</td>
<td>4.2</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
<td>1.72</td>
</tr>
<tr>
<td>2012</td>
<td>1443.44</td>
<td>170.1</td>
<td>4.3</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
<td>1.59</td>
</tr>
<tr>
<td>2013</td>
<td>1582.15</td>
<td>173.7</td>
<td>4.5</td>
<td>1.54</td>
<td>1.54</td>
<td>1.54</td>
<td>1.54</td>
<td>1.54</td>
<td>1.54</td>
</tr>
<tr>
<td>2014</td>
<td>1689.81</td>
<td>185.7</td>
<td>4.1</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
</tr>
<tr>
<td>2015</td>
<td>1783.36</td>
<td>197.4</td>
<td>3.0</td>
<td>1.22</td>
<td>1.22</td>
<td>1.22</td>
<td>1.22</td>
<td>1.22</td>
<td>1.22</td>
</tr>
<tr>
<td>2016</td>
<td>1965.93</td>
<td>219.7</td>
<td>1.9</td>
<td>2.24</td>
<td>2.24</td>
<td>2.24</td>
<td>2.24</td>
<td>2.24</td>
<td>2.24</td>
</tr>
<tr>
<td>2017</td>
<td>2273.94</td>
<td>245.6</td>
<td>1.3</td>
<td>2.39</td>
<td>2.39</td>
<td>2.39</td>
<td>2.39</td>
<td>2.39</td>
<td>2.39</td>
</tr>
</tbody>
</table>

**Figure 4. Data Set (Sources: CBM, NSO, and Eurostat)**
Data Analysis

Descriptive Statistics

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Independent Variable (y)</th>
<th>Property Price Index (based 2000=100)</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable 1</td>
<td>Tourists</td>
<td>1124.24</td>
<td>2273.84</td>
<td>1527.92</td>
<td>346.02</td>
<td>Thousands</td>
</tr>
<tr>
<td>Independent Variable 2</td>
<td>GDP</td>
<td>5386.14</td>
<td>11126.01</td>
<td>7581.98</td>
<td>1859.38</td>
<td>Euro Millions</td>
</tr>
<tr>
<td>Independent Variable 3</td>
<td>Unemployment Rate</td>
<td>1.30</td>
<td>4.80</td>
<td>3.81</td>
<td>1.14</td>
<td>Percentage</td>
</tr>
<tr>
<td>Independent Variable 4</td>
<td>Total Development permits, commercial, social and other Permits</td>
<td>1540.00</td>
<td>3752.00</td>
<td>2402.00</td>
<td>812.46</td>
<td>Integer</td>
</tr>
<tr>
<td>Independent Variable 5</td>
<td>Loans to construction and real estate</td>
<td>26.39</td>
<td>75.36</td>
<td>57.15</td>
<td>18.99</td>
<td>Percentage of total loans</td>
</tr>
<tr>
<td>Independent Variable 6</td>
<td>Annual average Index (HICP (2015 = 100))</td>
<td>83.79</td>
<td>102.18</td>
<td>94.12</td>
<td>6.40</td>
<td>Index</td>
</tr>
<tr>
<td>Independent Variable 7</td>
<td>Population</td>
<td>40499.00</td>
<td>460297.00</td>
<td>422939.25</td>
<td>17959.76</td>
<td>Thousands</td>
</tr>
<tr>
<td>Independent Variable 8</td>
<td>Minimum Wage</td>
<td>584.24</td>
<td>735.63</td>
<td>671.10</td>
<td>52.18</td>
<td>Euro</td>
</tr>
<tr>
<td>Independent Variable 9</td>
<td>Population aged 65 +</td>
<td>13.80</td>
<td>18.80</td>
<td>16.09</td>
<td>1.92</td>
<td>Percentage of total population</td>
</tr>
</tbody>
</table>

*N = 12

Table 1 provides a general description of the variables which are used in the Pearson’s Correlation Coefficient test and will aid in the description of the variables in the sections below.
The Dependant Variable

Property Price Index

The property price index provides an average change in property prices over a period.

![Property Price Index](image)

*Figure 5. Property Price Index (Source: CBM)*

The average property price index, as indicated in Table 1, is that of 185.33, implying an overall increase of 85% over 18 years. The highest point this index has reached is 245.60 which was recorded in 2017. Figure 5 indicates a positive upward trend line.

Explanatory Variables

Number of Tourists

![Number of Tourists](image)

*Figure 6. Number of Tourists (Source: CBM)*
Figure 6 represents the total number of tourists who visited Malta; the average over the 12-year sample was 1,527,920 with a standard deviation of 346,020. The maximum number of tourists was recorded at 2,273,840 in 2017.

**GDP**

![GDP Graph](image_url1)

*Figure 7. Gross Domestic Product (Source: CBM)*

The average GDP was recorded at €7,581,980 with a standard deviation of €1,859,380. The highest point of GDP was recorded in 2017 at €11,126,010. Overall the data depicted in Figure 7 shows a positive trend and, on average, has increased throughout the 12-year sample.

**Unemployment Rate**

![Unemployment Rate Graph](image_url2)

*Figure 6. Number of Tourists (Source: CBM)*

Figure 8 show the downward trend in the unemployment rate in Malta. Table 1 indicates that the minimum unemployment rate was recorded in 2017 at 1.30%. The average unemployment rate stood at 3.81%, with a standard deviation of 1.14%.
Figure 8 show the downward trend in the unemployment rate in Malta. Table 1 indicates that the minimum unemployment rate was recorded in 2017 at 1.30%. The average unemployment rate stood at 3.81%, with a standard deviation of 1.14%.

**Total Development Permits**

![Graph of Total Development Permits](image)

*Figure 9. Total Development Permits (Source: CBM)*

Table 1 indicates that the average amount of development permits issued per year stands at 2,402. Figure 9 shows that the overall trend is downward; however, one can note that an upward trend exists from 2013 which could be explained by a decrease in the cost for development applications (MEPA), combined with an increase in the GDP levels.

**Loans to Construction and Real Estate**

![Graph of Loans to Construction and Real Estate](image)

*Figure 10. Loans to Construction and Real Estate (Source: CBM; author’s own calculation)*

Data from Table 1 indicates that, on average, 57% of the total banks’ portfolio of loans is within the property industry with a standard deviation of 18.99%. The maximum amount of loans to the property index with respect to the banks’ portfolio of loans was recorded in 2008 at 75.36%.
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**Inflation Rate**

![Annual Average Price Index](image)

**Figure 11. Annual Average Price Index (Source: CBM)**

Table 1 indicates that the maximum value of the Harmonised Price Index was 102.18 recorded in 2017 as shown in Figure 11, implying price levels in Malta were 2% higher in 2017 than they were in 2015. Moreover, the average price level was 94.12 with a standard deviation of 6.40.

**Minimum Wage**

![Minimum Wage](image)

**Figure 12. Minimum Wage (Source: Eurostat)**
Table 1 indicated that the minimum wage in Malta on average is €671.10 and the standard deviation is €52.18. Figure 12 shows that the data depicts an upward trend due to the positive trend line.

**Population**

![Population Chart](image)

*Figure 13. Population (Source: Eurostat)*

Table 1 specifies that the average population in Malta stood at 422,939, whilst the maximum was 460,297 recorded in 2017 as shown in Figure 13. The population density in Malta defers from the European market since in Malta the population density stands at 1,325 persons per square kilometre compared to the 117 persons per square kilometre in Europe.

**Population aged 65+**

![Population of Age 65+] (image)

*Figure 14: Population of Age 65+*
Figure 14 depicts the population aged 65 and over as a percentage of the total population. The trend is positive showing that the amount of people aged 65 and over is increasing in Malta. Table 1 shows that on average 16% of the total population is 65 and over. However, the maximum stood at 18.80% in 2017.

**Data Analysis**

The data was analysed utilizing Pearson’s Correlation Coefficient which is a statistical measure of the strength of a linear relationship between paired data. Evans (1996) suggested that the values of correlation for the Pearson Correlation Coefficient could be classified thus:

<table>
<thead>
<tr>
<th>Pearson Correlation Coefficient</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 – 0.19</td>
<td>Very Weak</td>
</tr>
<tr>
<td>0.20 – 0.39</td>
<td>Weak</td>
</tr>
<tr>
<td>0.40 – 0.59</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.60 – 0.79</td>
<td>Strong</td>
</tr>
<tr>
<td>0.80 – 1.00</td>
<td>Very Strong</td>
</tr>
</tbody>
</table>

A significance test is conducted to decide whether, based on the sample utilized, there is any evidence to suggest that linear correlation is present within the population. The Pearson’s Correlation test was run on the dependent variable, the property price index, against all the explanatory variables to determine whether a relationship exists. The results were summarised in Table 3.

**Table 2. Correlation Effect Size (Source: Evans 1996)**

**Table 3. Summary of Results (Source: Author’s Calculation)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson’s Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>.877**</td>
</tr>
<tr>
<td>Tourists</td>
<td>0.902**</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>-0.962**</td>
</tr>
<tr>
<td>Development Permits</td>
<td>0.127</td>
</tr>
<tr>
<td>Loans</td>
<td>-0.874**</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.605*</td>
</tr>
<tr>
<td>Population</td>
<td>0.915**</td>
</tr>
<tr>
<td>Minimum Wage</td>
<td>0.619*</td>
</tr>
<tr>
<td>Population aged 65+</td>
<td>0.73**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level**

**Correlation is significant at the 0.05 level**
The Pearson’s Correlation value obtained in Table 3 for the Gross Domestic product is 0.877 which indicates that there is a very strong positive relationship between the two variables (Evan 1996). Moreover, the result is significant at the 0.01 level implying that the results of the sample can be inferred to the whole population. Similarly, the Pearson’s Correlation value obtained for the number of Tourists is 0.902 which indicates a very strong positive relationship. The correlation co-efficient of the unemployment rate is -0.962 which postulates a very strong negative relationship between the two variables. Similar results were obtained for the correlation coefficient of the number of loans indicating a very strong negative relationship of -0.874.

Even though the Pearson’s Correlation value obtained for development permits is 0.127, which indicates a very weak relationship between the two variables (Evan 1996), the result is not significant and can only be applied to the sample.

The Pearson’s Correlation value obtained for inflation is 0.605 which indicates a strong positive relationship between the two variables (Evan 1996) similar values where also obtained for the population and aging population, displaying correlation coefficient of 0.915 and 0.73 respectively. The minimum wage also played an important role in property price fluctuations as the correlation obtained is positive at 0.619.

Ethical Considerations

When analysing data, it was made sure that it was not manipulated in any way and that it is true to its original source of collection. Moreover, when the data was analysed it was ensured that no personal bias was included in the write up.

Conclusion and Recommendations

Discussion

The aim of this study is to analyse the factors which give rise to changes in property prices along with their strength in influencing the change in prices. The results obtained were compared to the a priori expectations formed from existing literature. The relationship between GDP and the property price index is a positive one, implying that when an economy experiences high levels of GDP property prices tend to be high too. Xu (2017) concluded that GDP has a positive relationship on the level of house prices. Using a Granger Causality Test it was found that an increase in GDP causes an increase in house prices and not vice-versa. Biagi et al. (2015) found that house prices in Italy are positively affected by tourism levels. This is in line with the results found in this study whereby, as shown in Table 3, a strong correlation exists between the number of tourists that visit Malta and the general house price index. Biagi et al. (2012) conducted another study in Sardinia which is in line with the results obtained, given that Sardinia is an island which shares various characteristics with Malta, it is highly significant that the results are also shared. Cannari and Faiella (2008) concluded similar results between tourism and house prices.

Economic theory states that when unemployment figures are high fewer people can afford a house and the fear of unemployment may discourage people from entering the property market (Sloman et al. 2013). Table 3 indicates that the relationship between unemployment and house prices is negative which is in line with economic theory. Jacobsen (2005) found that high unemployment figures affect house prices negatively which is explained through the linkage effects, since a higher level of unemployment results in a lower expectation of wage growth which will increase
uncertainty concerning future income and the ability to repay any debt obligations; subsequently this will reduce the willingness to pay for houses.

The results in Table 3 indicate a negative relationship between house prices and loans. This implies that, as credit for housing increases, the price of property will fall. This goes against what was found by Égert and Mihaljek (2007) in central eastern European countries. Wenzel (2012) contradicts this view and states that, when interest rates increase and the number of loans fall, property prices will still increase, implying that the opposite is also true; hence as interest rates fall, the number of loans will increase and property prices will fall.

A study in 35 major cities in China carried out by Kuang and Liu (2015) found that inflation has a positive and strong correlation with house prices. They concluded that inflation has a much stronger effect on house prices than house prices have on inflation. From their results it is safe to say that inflation is what causes house prices to increase. These results are in line with the finding of this study which as indicated in Table 3: a strong positive relationship was found between inflation and house prices. Similarly, population and house prices exhibit a positive and strong relationship as indicated in Table 3. This result is also shared by Mulder (2006) who found that population change leads to a change in demand for housing; population growth leads to a growth in housing demand which will increase the price of property. Furthermore, a study by Taltavull (2003) which utilised pooled data across 71 Spanish cities found that population has a very strong significance in explaining changes in house prices.

The results obtained in this study show that the minimum wage has a positive impact on property prices which is significant at the 0.05 level. The results obtained are in line with the study carried out by Gan and Hill (2018) who found a strong and significant impact between ages and house prices in Sydney, Houston, and the State of Texas. Similar to the results obtained by Pitkin and Myers (1994), an ageing population has a positive and significant effect on property prices in Malta. Table 3 shows that the correlation coefficient obtained is significant at the 0.01 level with a value of 0.73, implying a strong relationship. Finally, the results obtained for development permits were not significant, as shown in Table 3, at any level and hence no conclusion can be drawn about such a variable.

**Implications of the Study**

The results of this study indicate that various factors are contributing towards an increase in property prices. The implication is that these variables all contribute towards higher economic growth and a strengthening of the local economic system although this comes at the expense of residents living in Malta.
This is clearly shown in Figure 15 which depicts a widening gap between property prices and the minimum wage growth in Malta over the past 12 years. A study carried out by The Shelter in the UK (2014) found that house prices have been rising much faster than wages, making house more unaffordable in the UK. Based on the findings of this study, this is what the Maltese economy is experiencing and will result in similar repercussions as reported by The Shelter (2014) which include people being priced out of ownership and remaining trapped within the rental market. Such a phenomenon will increase the demand for the rental properties and prices will increase within that market too; in fact a study carried out by Central Bank of Malta (2016) reports that rental prices in Malta have increased. Even though such an increase cannot be solely tied down to the property price-wage gap, it could be one factor affecting such an increase in rental prices.

Lessard and Modigliani (1975) indicate that inflation within the housing market brings about various implications in an economy which include:

Wealth and income inequality since, as house prices increase, the newer generations find it much harder to climb the property income as first-time buyers must devote a higher percentage of their income to saving for a down payment and paying off the loan. Moreover, those who are not able to purchase a property will end up facing high rental prices. Finally, this will result in greater poverty figures in retirement since the norm is that a home loan would be paid off by retirement age, whereas rent will still have to be paid.

Intergenerational wealth inequality is another issue which high property prices are causing. De Nardi (2004) describes the phenomena of property being a bequest which can explain the emergence of various lifestyles among new generations. Such a bequest motive generates lifetime savings and wealth for new generations. Given the trend in house prices and the shift toward renting property, such bequest motives will no longer be possible and will impinge on future wealth which will affect future consumption behaviour.
Policy Recommendations

Property is one of the major contributor of the Maltese economy and controlling prices will be a very difficult task for policy-makers to undertake. However, government has undertaken various initiatives to elevate such a problem such as the introduction of the First-Time Buyers Scheme and of the Second-Time Buyers Scheme.

Government should introduce more initiatives which will allow buyers to afford property the same way they used to in the past decade. It is also important that the property market is not affected negatively because of the heavily reliance the Maltese economy has on it.

Both EU and non-EU countries have various schemes aimed at helping buyers acquire property. A hybrid system which would be ideal for the Maltese economy is the Shared Ownership Scheme of the UK. If an individual cannot afford a home loan, shared ownership offers the person the ability to purchase part of the home in share value whilst paying rent on the remaining share.

Another UK scheme is the Help to Buy: Equity Loan. Such a scheme will allow borrowers to borrow up to 20% of the cost of a new home from government and would only require 5% cash deposit with the remaining 75% would be taken from a financial institution. Figure 16 provides a visual overview of how such a system would work.

![Figure 16. Help to Buy: Equity Loan (Source: HM Government)](image)

Recommendations for Further Study

A more in-depth study can be undertaken to understand the interaction among all the independent variables and dependant variable through regression analysis. Future studies can consider including other macro-economic variables. The study can also be extended to the micro-economic factors in Malta to have a clearer picture of the determinants of property prices.

Conclusion

Based on the data collected and analyses, property prices have been increasing year on year; the rate of increase has outpaced the rate of growth in wages creating an ever-increasing gap. This will have serious repressions on an individual’s wellbeing as explained before. Moreover, as indicated in Table 3, the correlation between the population and house prices is very strong and the problem of an ever-increasing population is a persistent one within the local scenario and will put higher pressure on
house prices. This paper has outlined a few recommendations that policy-makers can consider to make housing affordable in order to reduce the potential negative impact outlined above such a situation might have on the economy.

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Lessard, D.R. and Modigliani, F. 1975. Inflation and the housing market: Problems and potential solutions,


How Effective is Apprenticeship to Learning? A Student Perspective

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Abstract: This qualitative study applies grounded theory methodology to investigate student perception on the effectiveness of the apprenticeship scheme on their learning. In-depth interviews were carried out with three second-year students reading for a MCAST Level 4 Advanced Diploma in Financial Services to gather insight on their experiences and their perception of the current apprenticeship scheme and how it contributes towards their learning. Through the analysis of grounded data, interrelationships between concepts have been examined based on contextual conditions, actions and reactions, and consequences and outcomes. The study proposes a model of factors affecting learning which will aid stakeholders to improve the current apprenticeship scheme.

Keywords: Learning; apprenticeships; student perception; organizations; financial services; MCAST; grounded theory.

Background to Study

‘Situated Learning’, as explained by Rogers and Horrocks (2010) with reference to Lave and Wenger’s (1991) study, focuses on how learners learn when they are put in a social situation and how they can also master the skills needed to be able to give back to the society. Guile and Young (1998) explore several approaches to learning and looks at learning from a social perspective, giving light to the idea of apprenticeships as a basis of a new pedagogical learning (keeping in mind that this paper was published around 20 years ago) and the idea of learning becoming a more social activity. They go on to explore the phenomenon of ‘learning by doing’ and the idea of learning through the collaboration of student and master.

Marianne Thyssen, European commissioner for employment, social affairs, skills, and labour mobility, has indicated that there is strong evidence of work-based learning as a tool for equipping young people with employability skills and to ease the transition from school to work. It is also noted that the European Commission (2017) encourages government, social partners, and education and training providers to promote apprenticeships and other forms of work-based learning.

Sultana (1995: 2001) traces apprenticeships in Malta as far back as the 14th century where they were associated with building trades, furniture production, and silverwork and continued to develop throughout time. Nowadays, apprenticeships or work-based learning are offered by VET providers MCAST and ITS (Cedefop 2017). MCAST currently offers over fifty apprenticeship courses across several programs at MQF Levels 3 and 4 as found on the official MCAST website (MCAST 2016). Over the past few years MCAST has introduced more courses on apprenticeship whereby students are given the opportunity to work at a company in their relevant industry to gain
industry experience and learn skills that give them the ability to make a smoother transition from the classroom to the workplace.

Cedefop (2017) suggests that this upward trend mirrors employer involvement. The publication notes that national data shows 900 interested companies in apprenticeship or work-based learning schemes; around 437 companies offered apprenticeships between 2013 and 2016 and a total of 455 placements were done between 2015 and 2016. Although apprenticeship courses are a step forward to bridging the gap between formal education and the work environment, Cedefop (2015) notes that, after consulting with various stakeholders, certain issues have been identified.

Two issues which are of interest to this research scope can be identified as ‘There is a mismatch between apprenticeship offer and labour-market needs’ and ‘Apprenticeship programmes follow a non-integrated approach’. Therefore, it is highly important to understand whether present competences are in fact being reached and if they are providing value to both the employer and the student. ‘Good preparation for jobs in demand is important, but not a guarantee of finding a matching job’ (Cedefop 2017: 17). This suggests that although one may be skilled for the job, how much can a person’s skill set really match what employers want.

To better identify how skill gaps can be filled more effectively, one needs to understand what skills students are being equipped with and if apprenticeships are adding value to providing the skills required by employers and students alike. In a recent study conducted in September 2017 by Management Partners Group (MPG 2017), an international management group, professionals working in Malta’s financial services industry expressed their expectation of strong growth over the next five years in their sector. In the same survey, to a question which asked whether they expected that recruiting talent from abroad to fill skill gaps would continue, 56% senior professionals answered that this trend will even increase. Due to the above findings, there is more reason to invest in offering a local training programme that meets these employers’ demands, especially in a growing industry sector like financial services.

The study aims to gather insights on what learning value apprenticeships give to students and the effectiveness of these apprenticeships as a learning tool for students following a MCAST Level 4 Advanced Diploma in Financial Services.

The selection of this particular course was mainly due to three reasons:

i. The researcher’s access to students and knowledge of the course and the apprenticeship programme. The researcher, having taught the selected group of students for two years, could give more meaning to insights gathered by students. The researcher has also taught the selected course for four years and thus is knowledgeable about the course and its deliverables. Moreover, since the introduction of this course on apprenticeship four years ago, the researcher has been assigned as a MCAST mentor on said course and thus the researcher has seen how it has developed over the years.

ii. As noted in (i), the introduction of the course apprenticeship scheme has only been functioning for four years and the cohort selected is the third one experiencing the programme. Therefore, although it is not a well-established programme, on the other hand is not in its inception phase, and therefore clearer insights can be taken especially for further research.

iii. Demand for skills in the financial services industry which, as noted previously, is growing substantially. It has also been noted that employers are not finding
the right skills and are resorting to employing talent from abroad. Therefore, this course has also been chosen to shed light on the importance of improving the apprenticeship scheme to better meet skill gaps in this industry.

Therefore, the research question set, and its corresponding objectives, can be expressed as:

**How do students perceive the effectiveness of apprenticeships towards their learning?**

The aim of this research sets to meet the following objectives:

1. Developing an understanding of what value employers give to students to understand better how the apprenticeship scheme is helping in the students’ learning experience.
2. Developing an understanding of how students feel that the apprenticeship scheme is contributing towards their learning.
3. Identifying what factors students perceive as necessary for an effective learning experience.
4. Identifying whether students feel that the current apprenticeship programme equips them with the right employability skills that match employers’ skill demand in their relevant industry.
5. Identifying whether students perceive that apprenticeships ease their transition from school to work.
6. Understanding what issues are present with the current apprenticeship scheme that hinder an effective learning experience.
7. Gathering recommendations on how apprenticeships can be improved to make the experience a more effective learning experience.

The development of the model extracted from insights obtained from students will give an indication of what students perceive as lacking within the present apprenticeship structure. It will also discover what is already giving value to students. The resulting insights will also attempt to derive suggestions from students that can be used as a basis for discussions with policy-makers, MCAST, and industry to improve the apprenticeship programme offered. The research aims to serve as a starting point for future research that will focus on expanding on the issues identified by the researcher through the objectives which address what value employers are gaining from students undergoing apprenticeships from a business standpoint.

**Grounded Theory Methodology**

Creswell (2014) described qualitative research as an approach to understand meanings that individuals or groups give to a social or human problem. This research takes on an inductive approach that tries to find the meaning of a situation by analysing data collected and identifying general themes that give meaning to the data. The researcher adopted a constructivist research philosophy using grounded theory as a research methodology.

Corbin & Strauss (1998) describe grounded theory as a theory derived from data, systematically gathered, and analysed throughout the research process. All parts of the research that is the method, data collection, analysis, and the emerging theory are in a close relationship to one another. The method of inquiry does not start out with a preconceived theory when an area of study is determined, and theory emerges from the data gathered throughout the research process. Corbin & Strauss (1998)
note that because grounded theories are drawn from data they are likely to offer insight, understanding, and provide a meaningful guide to action. Creswell (2014) refers to systematic steps to grounded theory as noted by Corbin & Strauss, namely the process of generating categories of information and the selection of one of these categories and positioning it within a theoretical model to narrate a story from the interconnection of the categories.

Three qualitative in-depth interviews were carried out with second-year students reading for a MCAST Level 4 Advanced Diploma in financial services. These students were chosen since they could give a more in-depth perception of apprenticeships than first-year students. One participant perceived their experience as being a positive experience whereas another participant described it as negative. The last participant had both a negative and a positive experience since they were employed in two different organizations during the apprenticeship.

The interviews were carried out in a semi-structured approach giving more importance to the participants’ opinions with the opportunity of the researcher prompting them on areas of relevance. The researcher could also intervene when the participants shared information that was not relevant for the research purpose. Sampling was carried out at two stages: convenience sampling followed by purposeful sampling.

Participant A was placed in a large banking institution throughout the two-year apprenticeship. The student perceived the experience as positive and therefore this student was chosen through convenience sampling to obtain insights on what makes a positive learning experience.

Participant B was placed in a small accounts and audit company throughout the two-year apprenticeship but was recently moved to a different section of the company specializing in HR functions. The student perceived the experience as a negative one and was therefore chosen through purposeful sampling to obtain insights on what make a negative learning experience.

Participant C was placed in two different organizations throughout the two-year apprenticeship. The first year of apprenticeship was carried out in a banking institution and was perceived as a negative experience whereas the second year was carried out in a small accounts and audit firm and was perceived as positive. This student was chosen through purposeful sampling for the sake of comparison between the two types of experiences in similar industries and organization size.

There was no need for theoretical sampling since the information gathered fulfilled the research objective.

Each interview was digitally recorded with the consent of each participant and transcribed and analysed using WEFT software application. WEFT allowed the researcher to analyse data and group into contextual conditions; actions and reactions; and consequences and outcomes. Interrelations between concepts were identified and examined.

Analysis of the Emerging Constructs

This grounded theory study based on the perception of three students reading for a MCAST Level 4 Advanced Diploma in financial services provides a framework for compiling the constructs relating to the perception students have with respect to the effectiveness of apprenticeships to their learning experience.
Corbin and Strauss (1998) argue that for researchers to build theory it is important to understand the phenomenon under investigation. They go on to describe the process as locating a phenomenon contextually or within the full range of macro and micro conditions, conditions that are broad or narrow in scope respectively, and of possible impact. They introduced an analytic device called ‘the conditional/consequential matrix’ to aid qualitative researchers in a practical way to keep track of various complex relationships within the analysis process.

As this research follows a grounded-theory approach, the ‘conditional/consequential matrix’ approach was adopted using WEFT software where themes were grouped into contextual conditions; actions and reactions; and consequences and outcomes. They were then further subdivided into subcategories. This can be seen in Figure One as a hierarchical structure where one can note the main concepts extracted from the study and lower-level concepts introduced as subcategories using a top-down approach. These themes were grouped because they shared properties with the main themes.

Figure 1 illustrates the structure as three main categories: contextual conditions, actions and reactions, and consequences and outcomes and 37 subcategories.

The contextual conditions portray the student’s perception of the fact that the three main stakeholders (the organizations, the student themselves, and MCAST) are the main influences in the apprenticeship scheme since their actions play a role in the consequences which represent the outcome of these actions. The main stakeholders are grouped into three subcategories (organization, student, MCAST) and further divided into subcategories which influence the actions and reactions which are divided into two subcategories: positive and negative actions, each with subcategories of what is either a positive or negative action which then results into consequences and outcomes.
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Figure 1. How effective is apprenticeships to learning: a student perception

The students' perception is central to the model since it determines whether apprenticeships are viewed as being effective to their learning. The main components of the apprenticeship programme the students have undertaken are the three stakeholders as mentioned before; however, all three students have mentioned their employer and MCAST as being main factors that influenced their learning placing emphasis on the organization's role in the scheme.

The student has been added as a factor in the contextual conditions as their characteristics also influence their perception. The subcategories for the students have been added considering what was said during the interview and grouped accordingly.

The organization as a contextual condition comprises of 6 subcategories: industry, size, organizational culture and working environment, Learning Environment, Reason for hiring apprentices, Experience with apprenticeships.

HOW EFFECTIVE IS APPRENTICESHIP TO LEARNING?
A STUDENT PERSPECTIVE

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Industry refers to the industry of employment; as noted previously students were placed in either the banking or the accounting industry. Size refers to the size of the organization, namely taking into consideration number of employees employed and labour resources availability. For this study, size characteristics consisted of large companies and small-to-medium enterprises.

Organizational culture and working environment refer to the culture of the organization and the working environment including elements such as organizational dynamics (work procedures, section attributes), attitude of employer and employees, and employee morale. Learning environment refers to the learning environment present in the organization taking into consideration training opportunities offered to full-time employees and to apprentices.

Reason for hiring apprentices refers to why organizations hire apprentices from the perception of the student. The final subcategory refers to the experience the organization has with apprenticeships.

All subcategories have a relationship with the roles, tasks, and objectives assigned which lead to all seven subcategories found within consequences and outcomes. Although the role as an action plays a crucial part of the effectiveness of the learning experience, there are several other relationships which need to be considered.

The type of the organization influences the roles and tasks assigned which consequently determine employability skills for the industry and a match between the course and the apprenticeship. Participant A feels that being employed in a bank will give them skills for the industry although systems change from one bank to another and thus there is a limit to the skills they have obtained since the system used is not necessarily the same for another bank.

On the other hand, Participant B argued that there was no match between the course and their job; the argument was that it would have been more ideal if this participant had applied for the Level 4 Advanced Diploma in Accounting to match the apprenticeship opportunity.

Participant C argued that although their first placement in a bank was well-matched to the course, obviously the skills were not. As for the second experience, although the type of organization may not necessarily match the course, the participant felt
that the skills gained in this field will help them for future roles in the financial sector. The size of the organization and experience with apprenticeships subcategories influence whether a dedicated mentor is assigned to students. Smaller companies tend to have several mentors who oversee the apprenticeship with no dedicated mentor whereas larger companies tend to have a dedicated mentor to oversee the apprenticeship. Companies having experience with apprenticeship tend to assign dedicated mentors.

The organizational culture and working environment also have a relationship with the overall attitude towards the apprentice and willingness to train. The learning environment also plays a crucial role in willingness to train. An organizational culture which is perceived to be a negative one with a sense of demotivation even from full-time employees usually presents an environment where the apprentice is looked upon as a burden or is there to do ‘the dirty work’ as suggested by Participants B and C. An organization that does not promote a learning environment, as was the case with participant B, leads to no proper training.

Reason for hiring apprentices has a relationship with the attitude towards the apprentices and willingness to train. Organizations that hire apprentices with the intention of teaching apprentices tend to have a positive attitude towards the apprentices and are willing to train them; however, as the case with Participants B and C’s first experience, organizations that hire apprentices because of shortage of staff, tend to assign mundane tasks with no intention of teaching apprentices and usually have a negative attitude towards them.

Experience with apprenticeships has a close relationship with setting tasks or competences for the students as was the case for Participant A who had an older student on apprenticeship before them which means that this organization knew what had to be done.

The above contextual conditions mentioned with their resulting actions and reactions result in all the consequences and outcomes, especially the outcome of students being equipped with the skills for the industry and a match or mismatch between the course and apprenticeship.

MCAST, as a contextual condition, comprises of 4 subcategories: Perceived role in apprenticeship, contract specifications, jobs listed on portal and competences, and assessment. These subcategories all play an important role in the research since MCAST provides the overall administration of the apprenticeship scheme and provides support required to both employer and apprentice as quoted by the obligations of MCAST in the apprenticeship scheme in the agreement signed between employer and apprentice.

This research will mostly discuss the administrative and support role towards the student since the latter is the protagonist of this research.

The perceived role in apprenticeship is, as the name suggests, the role students think MCAST has in the apprenticeship scheme. All the students perceive MCAST as having an administrative role, namely that of providing job opportunities and information on competences provided (discussed later as separate subcategories) and monitoring of companies, together with a support role. A direct impact in the student’s learning experience was not noted but a more indirect impact was found since students felt that the organization is what makes or breaks an effective learning experience.
Although the perceived role does not result in any tangible actions towards the effectiveness of learning, students noted the support given by MCAST mentors and their intervention where necessary. Participant A noted that the mentor’s intervention was a positive one since guidance was given to the employer as to what tasks are or are not acceptable; the participant also gave an example of another student who had a good intervention by a mentor since said student was given mundane tasks such as filing or scanning. This intervention ensured that the student received the best learning experience.

On the other hand, Participant C noted that they had minimal intervention from their mentor during the first year of apprenticeship which resulted in the student’s perception of MCAST as having little say in what goes on in the apprenticeship. Participant B had no mentor assigned; although the student feels that their experience may have been slightly better, it was still noted that it was mainly the organizational dynamics that affected their learning.

This aspect led to students recommending MCAST to have a more direct role especially in supervising organizations which leads to the subcategory contract specification. Another recommendation put forward was for MCAST to play a more active role in providing training to employers, or more specifically industry mentors, to ensure that they understand the aim of the apprenticeship scheme and how they should plan out the apprentices’ experience.

Contract specifications as a contextual condition refers to the contract signed between the students and their employers. Unlike other contextual conditions this is not a perception but refers to the actual contract signed. Participants noted that the contract does not specify what roles they are to undertake and what learning should occur however it is a general agreement between employer and apprentice. Participant C notes that the only thing covered in the contract is that the student is committed to learn and the company is committed to teach and does not specify what students should learn and what the company should teach.

Participant A, as stated earlier, noted that owing to the company having experience with apprenticeships, their employer took the initiative to set objectives and clear tasks; however, Participant B noted that the employer not only did not know what was to be taught but did not even know what course the student was studying for. Participant C noted that their first experience did not give acceptable tasks since, in their opinion, there was no clear competences in the contract that obliged both employer and apprentice to satisfy, hence hindering their learning experience. This led to the perception of companies having the opportunity to give out tasks that they deemed fit which were perceived as not being the right tasks to meet the apprenticeship requirements.

This highlights that there is no clear communication of competences (action) led to the participants having the perception that their employers did not know what they must teach. Participant C, after their negative experience in the first apprenticeship, took the initiative to communicate what they wanted to learn. The above experiences led to the recommendation to provide more information in the contract regarding competences and the consequence that most students might not be meeting the competences to satisfy the apprenticeship.

Jobs listed on the portal refers to the jobs offered to students on the MCAST portal. Students argued that not enough jobs were available in the financial services sector.
They argued that, being a big cohort, several students ended up finding their own apprenticeships as was the case with Participants B and C (second apprenticeship). This eventually led to some students having a mismatch between their course and the apprenticeship. This led to the subcategory of competences and assessment. All participants are under the impression that set competences were not available for their course. Moreover, they felt that competences must be set and communicated to employers; the action of no clear communication of competences arose since a set of competences do exist. The consequence of this led to meeting or not meeting competences.

All participants feel that the current mode of assessment is not enough to measure knowledge. Participant C argued that one could list anything one wants in the logbook whilst Participant B stated that in their first year they used their logbook to ‘blabber’ and ‘fill in the blanks’. Participant A argued that some students do not take the logbook seriously and that certain standards should be set on how the logbook is done.

Students were asked whether they thought the assessment should be done on the job with all participants agreeing that it would be more beneficial to their learning experience. However, Participant A put forward an interesting argument: since Participant A had a good apprenticeship that met the requirement of the course, Participant A might be at an advantage over other students that did not have a job that is relevant to the course. It was thus argued that these students might be in an unfair position to students who have a relevant job if the assessment took place on the job.

The student as a contextual condition was added as a factor since the students themselves play a role in how the apprenticeship experience is perceived. This contextual condition comprises of four subcategories: character, willingness to learn, expectations of apprenticeship experience, and apprenticeship duration.

The first three subcategories determine how students will perceive their experience. All participants were chosen due to their maturity and willingness to make the most of the apprenticeship experience. This has been added as a factor to give substance to the sample chosen. Apprenticeship duration was added as a factor to ensure that students had enough time at their apprenticeship to form a holistic opinion of their apprenticeship. All these subcategories ultimately lead to the student perception of the experience and give substance to the recommendations put forward by the participants.

As a result, the student perception of what makes an effective learning experience emerged. The table below identifies a list of factors and describe how these factors are perceived as being positive or negative factors to learning.
Table 2. A student’s perception of factors conducive to learning

<table>
<thead>
<tr>
<th>Factors</th>
<th>Positive factors to learning</th>
<th>Negative factors to learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Organization</td>
<td>The company operates in the industry or works closely with the industry related to the course apprentices are following which then equips them with the right employability skills for the industry.</td>
<td>The company operates in an industry not related to the course apprentices are following which, although it aids students with knowledge, it will not equip them with the desired employability skills for the industry.</td>
</tr>
<tr>
<td>Organizational Culture and</td>
<td>Irrelevant of the company’s size, if the organizational culture is a positive one which promotes learning, the apprentice will receive a good learning experience.</td>
<td>An organizational culture that does not promote learning and has a negative working environment will lead to the apprentice feeling demotivated and will receive only some learning.</td>
</tr>
<tr>
<td>Learning Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding of Apprenticeship Scheme</td>
<td>The company understands the apprenticeship scheme and its role in providing the apprentice with opportunities to learn. The organization hosts apprentices to aid their learning.</td>
<td>The company does not understand the apprenticeship scheme and its role in providing the apprentice with opportunities to learn but hosts apprentices to aid the company.</td>
</tr>
<tr>
<td>Industry Mentor</td>
<td>A dedicated industry mentor is assigned to the apprentices who oversees their training and is available to guide them should queries arise.</td>
<td>No dedicated industry mentor is assigned. Cases were industry mentor is assigned but is not willing or competent to train will also lead to a negative learning experience.</td>
</tr>
<tr>
<td>Roles and Tasks Given</td>
<td>Students are assigned roles with responsibility that are relevant to the course being undertaken. Moreover, various tasks in different sections offer a more holistic learning experience.</td>
<td>Mundane tasks or no specified roles offered to students with no responsibility leading to a negative learning experience.</td>
</tr>
<tr>
<td>Competences</td>
<td>Clear competences together with a plan of action of what apprentices will learn throughout the experience are ideally specified in the apprenticeship contract.</td>
<td>No clear competences and no plan of action for learning.</td>
</tr>
</tbody>
</table>

Implications for Stakeholders

The results of the study have various implications for the research stakeholders. The research shows that for students to have an effective learning experience from the apprenticeship, the organization plays a crucial role together with an indirect role by MCAST.

The main stakeholder in this study is the student since the apprenticeship scheme, as a tool, aids students’ learning and should equip them with knowledge for the industry together with helping them make a smooth transition from school to work. If they not do receive an effective learning experience, their experience will not satisfy these objectives.
The first element that was established as being a factor towards the effectiveness of the learning experience is the industry of the apprenticeship. One must take note of what type of jobs are being offered and in what industry. The students reading for this diploma are offered apprenticeships mainly in banks and accounting and audit firms. However, one must query if the industries being offered are indeed a match to the course being read for.

The course description as found on the official MCAST website (Figure 2) states that the Level 4 Advanced Diploma in Financial Services helps ‘Students develop and learn how to apply specialist knowledge within particular areas of banking and finance and the financial services environment.’ (MCAST, 2018) whilst also shedding light on career opportunities for students namely in ‘… the financial services sector, including commercial and specialist banks, fund management and administration, investment services, together with related entities’ (ibid.).

One could argue that, since there are related entities listed, any financial job will be satisfactory for this course. However, if one looks at skills from an economic point of view by looking at the classification of the industry for Gross Domestic Product (GDP) purposes, one can turn one’s attention to the NACE which refers to statistical classifications of economic activity in the European Union.

When calculating GDP by industry, financial services falls under section K. The NACE refers to Section K as Finance and Insurance Activities while another section of the NACE (Section M) refers to professional, scientific, and technological activities. Figure 3 shows the listed activities of both sections abstracted from the NACE Rev.2 published by Eurostat. As one can note, the accounting and audit industry is separate from the financial services industry.
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This brings about the question of what industries and roles students reading for the Level 4 Advanced Diploma in financial services should apply for to ensure that they are both meeting the course objectives and gaining knowledge for the industry they wish to work in.

To target this, MCAST should play an active role in vetting jobs being offered to students, especially those jobs which students find themselves. Moreover, students’ perception of what jobs are relevant for the industry should be more informed through communication by MCAST, ideally through information talks.

Another point is the availability of jobs needed to satisfy the number of students reading for this course. MCAST should raise awareness in the industry about the benefits of the apprenticeship scheme to attract employers from this industry, especially those in investment or fund management, to increase the opportunities offered and provide a better match for students. This will be discussed in the recommendations for further research section.

The second element that has been established is opportunities to learn which includes the organizational culture and learning environment, understanding of the apprenticeship scheme, industry mentor, roles and tasks given, and competences from the table above. This element contributes to students’ learning since the working environment and employer attitude play crucial roles in learning, together with the learning opportunities provided. The above aspects are backed up by a
legal document in the form of the apprenticeship agreement between employer and apprentice. References to the legal document between employers and students will be for the document as at academic year 2017-18.

This agreement lists down, as separate sections, the obligations of the employer, apprentice and MCAST. The section pertaining to the obligations of the employer highlights the employer’s obligations towards both the apprentice and MCAST. It is stated that the employer needs to provide the right training to ensure that the apprentices are achieving knowledge, skills, and competencies according to the training plan as guided by MCAST.

This brings about the argument of the lack of communication between MCAST and employers regarding competencies. Information sessions for employers should be done for employers to not only ensure that they understand their role in the apprenticeship scheme but also to give the necessary training to ensure that these competencies are met. This section calls for the employer to provide an industry mentor to monitor and ensure that the apprentice is receiving adequate training, one might argue that it is the employer who is responsible for the adequate training to be given and ensure that the right industry mentor is identified who is able and willing to provide such training. MCAST should also provide employers with training courses to help employers identify industry mentors within their organization and train them on how to deal with apprentices.

The section pertaining to the obligations of the apprentice highlights the apprentice’s obligation towards their employers and MCAST. It is up to the student to ensure that they are receiving the right training for their learning experience. This means that students also need to be aware of this training plan to give themselves a guide towards their learning goals and ensure that the employer is providing the right learning opportunities. Another way to combat this lack of communication is to list the competences as part of the contract which both apprentice and employer will sign.

**Recommendations for Further Research**

This research study, which can serve as a starting point for further research, is a preliminary investigation into the student perception of the effectiveness of apprenticeships towards their learning. Such research can be done across all courses on apprenticeships across the various institutes. Moreover, the study can be further enhanced by considering the perception of all stakeholders of the apprenticeship scheme, namely MCAST as an administrator, MCAST mentors as academics and part of the monitoring process, and, most importantly, organizations hosting apprentices.

The researcher intends to further this study in the near future by focusing on organizations’ perception to gain insights on perception of value return for offering to host apprentices; this will further open opportunities to study why certain organizations, especially in the financial services industry, are not hosting apprentices even though other studies, namely the MPG (2017) survey, showed that the perception of employers in this sector are not finding the right skill-set for the industry.
References


The Effect of Consumer Characteristics and Behaviour on Pork Consumption in Malta. A Quantitative Study

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Abstract: The pig industry in Malta is important for the local economy and food safety. As is reported in Galli et al. (2016), Maltese people eat protein-rich diets although the Agriculture and Fisheries Census 2014 issued by the National Statistics Office reports a decrease in the number of pigs being bred on the island. This paper intends to analyse the pattern of Maltese consumer behaviour regarding pork consumption, eliciting the crucial factors affecting local consumption. This study forms part of an ongoing research studying the characteristics and behaviours of the Maltese pork consumer aimed to help the stakeholders in the industry to focus their strength on what is really expected by the consumers. Data was obtained through an online survey with questions/statements related to the demographic characteristics of the respondent, several Likert scale statements to analyse the purchase behaviour, and finally two questions to obtain the respondents’ weekly pork consumption. The research tool was tested for its reliability through an SPSS test, obtaining a Cronbach’s alpha value of 0.534. Data was reduced through Factor Analysis, from 17 factors to 5. The VARIMAX test was used to carry out the rotation necessary to reduce data. A resultant 5 factors gave 63% of the total variance in only 6 iterations and this was shown clearly in the scree plot. These five factors were named Product Quality, Peer Influence, Health Issues, Ethnocentrism, and Product Information. Statements found in the research tool were grouped according to their respective new factor and were analysed for their normality. Since the number of respondents was fewer than 100, the Shapiro Wilk test was used to determine if the data has a normal or non-normal distribution. All 5 new factors resulted skewed and therefore the Spearman Correlation test was used to test for the relationship between the Independent variables and the Dependant variables, between the Independent variables themselves, and between the Independent variables and the demographic information gathered. The correlation resulted significant in one Independent variable versus the Dependant variable, in 4 results between the Independent variables themselves, and in 4 results with regard to the relationship between the Independent variables and the Demographic factors. These results give a better picture of the local purchasing behaviour in relation to pork consumption as no previous study in this regard has been published locally before. It is intended to continue studying this phenomenon in the near future by increasing the sample size and making changes to the research tool in order to improve its reliability.

Keywords: Pork consumption; Malta, quantitative research; online survey; factor analysis; product quality; peer influence; health issues; product information; ethnocentrism; theory of planned behaviour.

Background to Study

Pig breeders always complain that local pork consumption is decreasing year by year although they insist that their product is of excellent quality and even superior to the...
imported one. The researcher feels these two statements contradict each other and this research attempts to find out what affects the choice of the Maltese consumer regarding pork. All this is sustained in various reports published over the years. According to the Agriculture and Fisheries Census (2014), there are 100 pig farms on the islands which supply the local market with fresh local pork. These farms are scattered around the islands as shown in Figure 1, with most of them concentrated in the central and southern part of the main island for the obvious reason that feed mills and the slaughterhouse are found in Marsa close to the harbour.

Table 1 illustrates what happened to the pig production in the Maltese islands between 2010 and 2014 which witnessed a decrease of 32.8% in the total number of heads and a 33% decrease in the breeding stock.

Figure 1. Pig farms by district (Source: Agriculture and Fisheries Census, 2014)

Table 1 illustrates what happened to the pig production in the Maltese islands between 2010 and 2014 which witnessed a decrease of 32.8% in the total number of heads and a 33% decrease in the breeding stock.
of food consumption higher than its ecological footprint of food production because
are found in countries such as Portugal and Malta. Malta has an ecological footprint
(2016) it is stated that protein-intensive diets
in the same study carried by Galli
et al. consumption patterns based on animal products. Malta is not an exception because
with urbanization and rising incomes, typical dietary patterns are shifting towards
this can lead to better wages and family income. Pimental and Pimental (2003) state that,
which also leads to an improved economy. If the economy of a country improves, this
adequate food supply. Increase in population leads to an increase in the work force
60% increase in agriculture production is needed from 2006 to 2050 to provide an
production needs to increase. Alexandratos and Brunisma (2012) projected that a
32% higher than today (UN-DESA 2015). To feed such a great population, food
person and in absolute terms. By 2050 the world's population will reach 9.7 billion,
more resources than ever are now being consumed, both per person and in absolute terms. By 2050 the world's population will reach 9.7 billion, 32% higher than today (UN-DESA 2015). To feed such a great population, food production needs to increase. Alexandratos and Brunisma (2012) projected that a 60% increase in agriculture production is needed from 2006 to 2050 to provide an adequate food supply. Increase in population leads to an increase in the work force which also leads to an improved economy. If the economy of a country improves, this can lead to better wages and family income. Pimental and Pimental (2003) state that, with urbanization and rising incomes, typical dietary patterns are shifting towards consumption patterns based on animal products. Malta is not an exception because in the same study carried by Galli et al. (2016) it is stated that protein-intensive diets are found in countries such as Portugal and Malta. Malta has an ecological footprint of food consumption higher than its ecological footprint of food production because

<table>
<thead>
<tr>
<th>MALTA</th>
<th>Total Heads</th>
<th>Young Pigs (including piglets)</th>
<th>Fattening Pigs &gt;50 Kg</th>
<th>Pigs Breeding Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>70,583</td>
<td>36,062</td>
<td>27,631</td>
<td>6,890</td>
</tr>
<tr>
<td>2011</td>
<td>46,287</td>
<td>23,686</td>
<td>17,567</td>
<td>5,034</td>
</tr>
<tr>
<td>2012</td>
<td>45,209</td>
<td>24,093</td>
<td>15,838</td>
<td>5,278</td>
</tr>
<tr>
<td>2013</td>
<td>49,451</td>
<td>25,067</td>
<td>19,102</td>
<td>5,282</td>
</tr>
<tr>
<td>2014</td>
<td>47,465</td>
<td>23,048</td>
<td>19,803</td>
<td>4,614</td>
</tr>
</tbody>
</table>

The National Statistics Office (NSO) World Food Day Report (2014) also states that pork production in Malta decreased from 7,369 tonnes in 2009 to 5,920 tonnes in 2013. This shows a downward trend in consumption of local pork despite the average household income being over 41% higher in 2015 than in 2007 which shows increased spending power and a contributing decline in the inactivity amongst women from almost 69% to just over 56% in the same period (Bamber 2017). All this could change family time management and life-style, including pork consumption. This research studies 5 factors which, in the author's opinion, can indicate sound reasons for the decline in local pork consumption.

**Literature Review**

Agriculture in Malta is in a decline but the demand for agricultural products in the world is on the increase. This is sustained by research carried out by Galli et al. (2016) who state that more resources than ever are now being consumed, both per person and in absolute terms. By 2050 the world’s population will reach 9.7 billion, 32% higher than today (UN-DESA 2015). To feed such a great population, food production needs to increase. Alexandratos and Brunisma (2012) projected that a 60% increase in agriculture production is needed from 2006 to 2050 to provide an adequate food supply. Increase in population leads to an increase in the work force which also leads to an improved economy. If the economy of a country improves, this can lead to better wages and family income. Pimental and Pimental (2003) state that, with urbanization and rising incomes, typical dietary patterns are shifting towards consumption patterns based on animal products. Malta is not an exception because in the same study carried by Galli et al. (2016) it is stated that protein-intensive diets are found in countries such as Portugal and Malta. Malta has an ecological footprint of food consumption higher than its ecological footprint of food production because
most of the consumed products are imported. This dependence can be reduced by increasing the demand for local products, such as local pork. Apart from reducing the ecological footprints, this will increase work opportunities, especially for young farmers. The local farming sector has an ageing problem; therefore an increase in the demand for local products will increase the interest in such an important sector which in Malta is slowly dying. According to Farrugia et al. (2016), knowing the behaviour and motivations of consumer purchasing can help the production and distribution companies to establish effective marketing strategies to maintain or increase their share of the domestic and international markets. Local industry needs such knowledge to improve their supply-and-demand chain.

To carry out a proper consumer behaviour survey, one needs to consider six demographic characteristics: age, sex, marital status, income, occupation, and education. All or some of these factors can affect the outcome of the survey as these demographic variables can reveal ongoing trends that signal business opportunities, such as shifts in age, gender, and income distribution. Schiffman et al. (2012) state that the product needs and interest vary with consumer age. Demographers draw an important distinction between age effects (occurrences owing to chronological age) and cohort effects (occurrences owing to growing up during a specific time period). The first stresses the impact of ageing, whereas the second stresses the influence of the period when a person is born and shares experiences with others of the same age. Gender roles nowadays are so blurred that this does not always help in distinguishing consumers in some product categories. One change affecting marketers nowadays is that women are not so readily accessible through traditional media as they once were. Nowadays, working women do not have much time to watch television or listen to the radio. People have more access to online information and they are more reachable there rather than on traditional media. According to Smith (2001), men tend to click on a website because they are ‘information hungry’, whereas women click on because ‘they expect communications media to entertain and educate’. With regard to marital status, traditionally the family has been the focus of most marketing efforts and the household continues to be the relevant consuming unit for many products and services. One-person households with income greater than €50,000 comprise a market segment that tends to be above average in the use of products not traditionally associated with supermarkets and below average in their consumption of traditional supermarket products (e.g. ketchup, peanut butter, mayonnaise). Income, education, and occupation categories play a role in consumer behaviour. Marketers commonly segment markets on the basis of income because they feel that it is a strong indicator of the ability (or inability) to pay for a product. In some studies, high income is combined with age to identify the important affluence of the elderly segment. ‘Education, occupation and income tend to be closely correlated in almost a cause-and-effect relationship. High-level occupations that produce high incomes usually require advanced educational training. Individuals with little education rarely qualify for high-level jobs. Insights on internet usage preferences tend to support the close relationship among income, occupation, and education. Research reveals that consumers with lower incomes, lower education, and blue-collar occupations tend to spend more time online at home than those with higher incomes, higher education, and white-collar occupations’ (Schiffman et al., 2012).

With more women joining the work force, people have less time for their families. According to Warde (1999) and Buckley et al. (2007), people are eating convenience food because they have other pressing obligations and it solves meal-scheduling problems. This means that more people choose to consume processed products or ready-made meals instead of buying fresh products and preparing their meals.
themselves. McKenzie (1986) reports that, although working women contribute to financial enrichment of the household, a situation of ‘time poverty’ may develop. This leads to less time available for household chores and meal preparation (De Boer et al. 2004). Apart from the constraints emerging from a change in lifestyle, the subjective norm can be influenced by an individual’s desire to act in accordance with expectations of friends, family, and social groups (McKnight 2007). According to Vermier and Verbeke (2004), social pressure from peers can influence purchasing intentions regardless of relatively negative attitudes. On the contrary other studies have concluded that subjective norms have no significant effect on purchasing intention (Patch et al. 2005) because one can be affected by other factors such as the geographic, demographic, and social environments one grew up within. The lack of agreement on this point can be due to the effect of the country under study. People in different countries can behave differently. According to Kurajdova et al. (2015), such environments can influence people’s desires, needs, preferences, attitudes, and interests that ultimately have an impact on their consumer behaviour. Another paper by Farruggia et al. (2016) states that several studies have been carried out about the ethnocentric behaviours through which consumers express a priority, a preference to products originating in their country or region driven by the belief that the purchase of domestic products is valuable to support the economy of their countries. Similar thoughts are shared by Schiffman et al. (2012) in Consumer Behaviour, a European Outlook. The authors comment that highly ethnocentric consumers are likely to feel that is inappropriate or wrong to purchase foreign-made products because of the resulting economic impact on the domestic economy. On the other hand, non-ethnocentric consumers tend to evaluate foreign-made products more objectively for their extrinsic characteristics (e.g. ‘How good are they?’). The latter are more receptive to products made in foreign countries. Ethnocentrism can vary by country and product. Byeong-Joon Moon (2004) points out that the attitude of consumers with little knowledge about a product is more strongly influenced by country of origin perceptions than the product attitude of consumers with high knowledge.

Another variable that affects consumer purchase behaviour is price. Buckley et al. (2007) insist that getting value for money is important especially among low-income people compared to those who are better-off. For Williams et al. (2012) price is one of the main factors considered in purchasing decisions by consumers because it can gain more influence on consumer behaviour among low-income groups. This means that income plays a key role in consumer behaviour as well. According to Osman et al. (2014), the fast growth of disposable income among urban consumers has enabled them to have more opportunities to consider a wider array of products and services compared to those in rural areas. Schiffman et al. (2012) note that the consumer perceives a price as high, low, or fair and this has an effect on purchase intentions and satisfactions. Moreover, the authors comment that products advertised ‘on sale’ tend to create enhanced customer perceptions of savings and value. Consumers tend to compare price with quality as well. There are a number of studies which state that consumers rely on price as an indicator of product quality. Schiffman et al. (2014) state that consumers attribute different qualities to identical products that carry different price tags and that such consumers’ characteristics as age and income affect the perception value. Liechtenstein et al. (1993) have found that consumers using a price/quality relationship are actually relying on a well-known, and hence more expensive, brand name as an indicator of quality without actually relying directly on price per se. In most consumption situations, in addition to price, consumers also use such cues as the brand and the shop in which the product is bought to evaluate its quality, as is shown in Figure 2.
Health issues are another variable which affects consumer behaviour when they come to purchase food. According to Brunso et al. (2002) healthy eating is gaining considerable importance. Kurjadova et al. (2015) found that, the higher education, the more people identified ‘health issues’ as barriers. Conversely, Osman et al. (2014) report that people tend to eat fast food because it is inexpensive compared to eating salad or other healthy food. People who interest themselves in healthy eating note product appearance and label information more. Such an important variable cannot be ignored because, as Osman et al. (2014) concluded, food marketers should improve their product packaging and quality to reflect healthy convenient food. James et al. (2002) also conclude that colour plays a key role in the perception of the quality of consumables and it is in some way connected to health aspects. Grunert (1997) divides the quality in two attributes: quality expectation and quality experience. According to Erickson et al. (1984), quality expectation is when a consumer will look for the brand, country of origin, and price, while Olson and Jacobi (1972) state that the quality experience depends on the taste, smell, colour, freshness, and nutraceutical properties. These attributes can be earmarked by the consumer during purchase and after consumption. Probably the first attribute is more easily applied during purchase while the latter one, since it is classified as a physical characteristic, would be applied at home as far as pork is concerned. Olson and Jacobi (1972) also describe quality as a subjective concept that depends on the perception, the needs, and objectives of the individual consumer.

Another factor to be considered when studying consumer behaviour is purchasing behaviour. Schiffman et al. (2012) say that consumers make three types of purchase: trial purchases, repeat purchases, and long-term commitment purchases. In a trial purchase, the consumer tends to evaluate the product through direct use. Normally this type of purchase is done on consumables, such as food or detergents which cost a few cents. Consumers can be encouraged to try a new product through promotional tactics, like free samples and/or sale prices. On the other hand, repeat purchase behaviour is closely related to the concept of brand loyalty, which most firms try to encourage because it contributes to greater stability in the marketplace. A repeat
purchase usually signifies that the product meets with the approval of the consumer who is willing to use it again and in large quantities.

**Research Question and Objectives**

This research aims to identify the characteristics and behaviours that affect pork consumers. To reach this aim, the researcher intends to use the Theory of Planned Behaviour to explain the relationship between the independent variables of product quality, product information, ethnocentrism, peer influence, health issues, and the dependent variable which is consumer behaviour when consuming pork meat.

The main objectives of this study are:

i. To obtain a clear view of what affects consumer behaviour when it comes to purchasing pork meat;
ii. To analyse how product quality, product information, health issues, peer influence, and ethnocentrism interact between themselves and affect the dependant variable which is pork consumption.

**Hypotheses**

H1: There is positive relationship between product quality and pork consumption.
H2: There is positive relationship between ethnocentrism and pork consumption.
H3: There is positive relationship between peer influence and pork consumption.
H4: There is negative relationship between health issues and pork consumption.
H5: There is positive relationship between product information and pork consumption.

![Figure 3: Conceptual framework](image)

**Research Methodology**

The method of enquiry for this research is a cross-sectional study performed once to collect information about the behaviour of Maltese pork consumers. The researcher has taken into consideration the Theory of Planned Behaviour (TPB). The main aspect of TPB is the person’s intention to perform the behaviour. The
stronger the intention, the more likely the individual will perform the behaviour. The TPB assumes that there are three theoretically independent factors that jointly influence intention. Attitude and Behaviour beliefs refer to the degree to which the individual has a positive or negative evaluation of a certain behaviour. Subjective norm or normative beliefs are the social pressure to perform or not perform the given behaviour. It refers to the influence family and friends or colleagues have on the behaviour. The third factor is the control factor. People are expected to carry out their intentions when the opportunity arises or there will be no barrier between them and their intention (Ajzen 1991).

According to d'Ardienne et al. (2011), the TPB has proven to have strong predictive power. This model, originally developed by Fishbein and Ajzen in 1975 as the Theory of Reasoned Action, was expanded into the Theory of Planned Behaviour by Ayzen in 1985. Such a powerful model proved useful for this research, since the researcher used part of the factors affecting the TPB. Schiffman et al. (2012) state that, if researchers wish to ask consumers about their purchase preferences and consumption experience, they can do so in person, by telephone, by post, or online. Each of these survey methods has its own advantages and disadvantages. According to the literature, since most people nowadays work and so are very difficult to reach, the best method would be an online survey.

This cross-sectional study uses a questionnaire based on the TPB toolkit as explained by d'Ardienne et al. (2011) to develop the tool to gather the needed information. The Likert scale used is from ‘Strongly Disagree’ to ‘Strongly Agree’ as suggested by d'Ardienne et al. (2011). d’Ardenne and Nicholls (2010) found that using negative and positive items in a questionnaire can cause confusion in some respondents and they suggest that agree/disagree questions should not contain negative questions/statements. The online survey is divided into three sections. The first part contains five questions asking about the demographic characteristic of the respondent which are age, family size, locality, annual family income, and level of education. The age under research is between 20 and 60+, family size between a one person to a 5+ person household, annual family income up to €60,000+, and the level of education from secondary to doctorate level. As far as locality is concerned, three sections were identified, the North, Central, and the South part, as it is easier for the Maltese people to choose.

In the second part there are 17 statements related to the Control and Normative beliefs. The intention to focus on these two is due to the limited time and length of the questionnaire. The statements in this part of the survey are about the quality of the product, peer influence, ethnocentrism, health issues, and knowledge about product information. Answers for this part are analysed through a Likert scale because, according to Schiffman (2012) and d’Ardienne et al. (2011), it is the most popular form of attitude scale used as it is easy for the researcher to prepare and to interpret, and simple for the consumers to answer. A principal benefit of the Likert scale is that it gives the researcher the option of considering the responses of each statement separately or of combining the responses to produce an overall score. The latter is the intention of the present researcher after running a Factor analysis. The last part of the online survey contains two questions about pork consumption, relating to the frequency and amount of pork consumption per week. In this part, the data is collected through an interval scale. Therefore, the questionnaire has 24 questions in total. The questionnaire is developed through Google Drive and disseminated through Facebook. The sample was taken from Facebook contacts where the researcher uploaded the questionnaire and all meat-lovers had the opportunity to answer the questionnaire.
on a first-response basis. There was no control on who answered the questionnaire so as to reduce the risk of having a convenient sample as much as possible, but the population was stratified as only meat-lovers were asked to answer the questionnaire. This was because the research studied the behaviour of meat-lovers in relation to pork purchasing and consumption. The study intended to have a confidence level of 95% and a confidence interval of 10, based on a Maltese population of around 400,000 people. Therefore, according the survey sample calculator, 96 questionnaires needed to be collected (https://www.surveysystem.com/sscalc.htm#one).

Analytic Procedures

This research adopted a positivist philosophy with a deductive approach. Data was gathered in a quantitative manner, inserted in a database, and analysed through SPSS version 24. The survey tool was analysed for its reliability and checked for its alpha value. The statements with a Likert scale were analysed through a factor-reduction test known as Factor Analysis. The data was analysed through a Scree plot with the help of VARIMAX rotation method. The researcher was then able to reduce the number of factors to around five which made them more manageable while the means of each factor could be worked out after grouping the questions. The new five factors which came out from the reduction exercise were analysed for their correlation to see if there was multicollinearity between the new variables. The correlation test was selected after analysing the new factors for normality with a Shapiro Wilk test. As the data coming from the Likert scale questions resulted in a skewed distribution, the Spearman correlation test was used. Figure 4 describes Phase 1 of data analysis and Figure 5 describes Phase 2 of data analysis.
Research Findings

This research was quantitative and all data was analysed through SPSS. Respondents answered all questions, therefore no missing data was found. The data was tested for the average inter-item correlation with a reliability test and the Cronbach’s Alpha value came to 0.534. Factor analysis was used to reduce the number of factors from seventeen to five. This was carried with the help of VARIMAX rotation. Five factors with an eigenvalue of more than one were found in six iterations and showed 63% of the total variance. This was shown very clearly in the Scree plot in Figure 6. The new factors were associated with product quality, peer influence, health issues, ethnocentrism, and product information as seen in Figure 3. After analysing the Rotated Component Matrix (Figure 6), the thirteen statements in the survey were grouped according to the new factor and the average of each respondent with regard to the new factor was worked out. Factor One got four statements, Factor Two two, Factor Three three, Factor Four two, while Factor Five got two as well.
Analysis showed some correlation between the Dependent and Independent variables and between the Independent variables themselves. Only one Independent variable achieved a correlation of 0.334 and a p-value of 0.004 with the Dependant variable. This Independent variable is product quality’s poor positive correlation means that when quality increases, consumption increases, but not always. The other Independent variables achieved a poor positive correlation with the Dependent variable except for product information where the correlation was close to zero. For these 4 Independent variables the p-value was more than 0.05; therefore no significance emerged. When it comes to multicollinearity, which means the correlation between the new Independent variables, only four obtained a significant result of a p-value less than 0.05. These were product quality versus peer influence, product quality versus health issues, product quality versus ethnocentrism, and product information versus ethnocentrism.

With respect to correlation, all achieved a poor correlation which varied between 0.231 and 0.298. This is a positive finding because the researcher anticipated that his Independent variables would have a strong correlation with the Dependent variable which is pork consumption and a poor correlation between the Independent variables themselves. The latter finding was reached in this research as even the other results show low correlation between the Independent variables themselves but achieved a p-value higher than 0.05 as well. Regarding the demographics section this research found out that there is a low negative correlation between the annual family income and product quality, which means that as the family income increases the less priority is given to the product quality. The correlation between the two is
that of -0.244 with a p-value of 0.04. This agrees with the studies carried out by Warde (1999), Buckley et al. (2007), McKenzie (1986), and De Boer et al. (2004) as they state that the increase in income can result from having both parents working, therefore less time for meal preparations. This will lead to families consuming more prepared meal or processed products. Another significant correlation was observed between age and pork consumption. The researcher observed a negative correlation of -0.234 with a p-value of 0.05. This agrees with what is written by Schiffman et al. (2012) that product needs and interest vary with consumer age. Brunso et al. (2002) also comment that healthy eating is gaining considerable importance. Another two variables that achieved a correlation, were age versus family size. They achieved a correlation value of -0.465 and a p-value of 0.000. This can mean that as people get older their family size decreases which makes sense because as the parents grew older the children leave their home and therefore the family size become smaller. The last two variables that achieved a significant correlation were income versus education. Their correlation was that of 0.250 with a p-value of 0.036. This agrees as well with Schiffman et al. (2012) who state that high-level occupations that produce high incomes usually require advanced educational training.

The first part of the survey which was about the demographics of the respondents was not included in the statistical tests. This part was divided into 5 questions: age, family size, locality, annual family income, and education. With regard to age, 32.4% were between 20 and 29 years old, 32.4% were between 30 and 39 years old, 25.4% were between 40 and 49 years old, 2.8% were between 50 and 59 years old, and 7% were over 60 years old. This agrees with Schiffman et al. (2012) who states that young people have more access to the internet. The survey was filled by a very low number of one-person households as this resulted in only 2.8%; 15.5% were 2-person households, 36.6% were 3-person households, 26.8% were 4-person households, and 18.3% were households of more than 5 persons. Most of the respondents were from the central part of the island (47.9%), 28.2% from the north, and 23.9% from the south. This could be because most people in Malta live in the central part. Regarding income there were 11.3% earning less than €14,999, 35.2% earning between €15,000 to €29,999, 36.6% earning between €30,000 to €44,999, 14.1% earning between €45,000 to €59,999, and 2.8% earning more than over €60,000. The education level of the respondents was as follows: 2.8% secondary level, 29.6% post-secondary level, 40.8% graduate level, and 26.8% masters level. This difference in the demographic characteristics of the respondents may have affected the reliability and stability of the results. More in-depth research is needed in this regard. There were two questions at the end of the survey covering the Dependant variable. From them it results that 62% of the respondents eat pork once a week, 31% two to three times a week, 2.8% four to five times a week, and only 4.2% consume pork six to seven times a week. As regard consumption in kilograms, 40.8% consume less than 1 kg per week, 29.6% consume between 1 to 1.99 kg, 21.1% consume between 2 to 2.99 kg, 2.8% consume between 3 to 3.99 kg, and 8.4% consume between 4 to 6 kg weekly.

Conclusion

The main aim of this study is to help local stakeholders in the pork industry focus their effort more wisely to meet consumer demand. After analysing the data gathered through the survey, there resulted a positive correlation between product quality and pork consumption. This means that local consumers expect quality when they purchase pork for consumption. Another positive correlation found was that between product quality and peer influence. The best promotion comes from satisfied customers. Therefore, butchers and meat-processing outlets should focus more on
quality as this pays off. During data analysis, it was additionally found that pork consumers positively associate product quality with health issues. Nowadays people are more aware of health issues and reach for high-quality products. Something that goes hand-in-hand with this is the positive correlation between product information with health issues. This means that more information on the product label can lead increased sales. Normally consumers associate quality with a brand and a ‘Made in’ on the product label can help as well. This study showed a positive correlation between product quality and ethnocentrism which means that consumers put weight on the origin of the product with most preferring local products as they believe that they are of high standard and their purchase would help the local economy. Osman et al. (2014) and Erickson et al. (1984) sustain all this. As a suggestion for the industry, one should focus more on product quality and the information on the product itself which helps the consumer make the right choice. On the other hand, there was a negative correlation between annual family income and product quality and age versus pork consumption. If marketers would like to promote pork products, it would be wiser if they target teenagers and middle-aged people as there is a tendency for pork consumption to decrease as age increases.

This research is already shedding light on what the stakeholders in the pork industry can do to improve their output but, for this research to be more significant, it is important that the research tool should be improved to get a higher alpha value, i.e. more than 0.7. This will make the survey more reliable; by repeating the study, the tool can become more valid. The new tool must focus more on the newly emerged factors and, if possible, one must consider gathering the data with more than one survey method. In this research only an online survey was used. Future research can consider using the in-person or telephone survey technique to reach respondents who do not have a Facebook account or are not computer literate.

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The Attitudes of Maltese Consumers Towards Renewable Energy: An Investigation

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Abstract: This study investigates the attitudes of Maltese consumers towards renewable energy by applying a grounded theory methodology and using a constructivism approach. The research adopts an interpretivist research philosophy. Qualitative in-depth interviews were carried out with five members of the general public, aged 40 to 55 years, to explore their attitudes towards renewable energy. Through the analysis of grounded data, interrelationships between concepts have been examined. This has been based on contextual conditions, actions and reactions, and consequences and outcomes. The study proposes a model of attitude formation towards renewable energy systems in the Maltese context. It has also identified three categories of consumers for renewable energy systems. The model will aid policymakers and resellers of these systems.

Keywords: Renewable energy; renewable energy systems; attitudes; consumers; grounded theory.

Background

Statistics published by Eurostat in February 2017 have indicated that Malta is the EU state with the lowest percentage of gross final energy consumption derived from renewable energy (Eurostat 2017). More initiatives are required for Malta to reach the 2020 target which has been set by EU for member states (ibid.).

Renewable energy is a type of energy derived from natural sources, rather than fossil fuels (ARENA, 2017). The form of energy which is feasible to Malta given various environmental factors, such as cost, geographical structure, size, and climate is solar energy of which there are two types—solar photovoltaic systems and solar thermal technology (EIA 2017). In this paper, renewable energy systems refer to solar photovoltaic systems.

The Maltese government has launched new solar panel schemes to encourage demand for renewable energy, both by households and businesses, by making these systems more affordable. (Ministry for Rural Affairs 2017; Times of Malta 2016; Times of Malta 2013). A white paper for a new legislation on renewable energy is under discussion (Camilleri 2017). The change in legislation and the government’s financial subsidies have not been enough to encourage consumers buying renewable energy systems. The reluctance of Maltese customers to purchase renewable energy systems led to the theme of this study.

Consumers’ buying behaviour is strongly determined by their attitudes towards products and services (Fazio and Olson 2003; Fishbein and Aizen 1975; Jansson 2010). This is also the case the attitudes of Maltese consumers towards this alternative form of energy.
Different authors have concluded that attitudes are a major influencer on consumers’ purchase behaviour (Fazio and Olson 2013; Fishbein and Ajzen 1975; Jansson 2010). ‘Attitudes are expected to predict and explain human behaviour. If a consumer has a positive attitude towards a product or brand, the consumer will buy the product or brand’ (Ajzen 1977: 12). Therefore, understanding attitudes is required to analyse why Maltese consumers are reluctant to purchase renewable energy systems.

Attitude formation has been defined by Schiffman and Kanuk as ‘the process by which individuals form feelings or opinions towards a brand or service or a retail establishment’ (Schiffman and Kanuk 2004: 102). Psychologists state that the formation of attitudes by consumers towards products is the result of the interplay of different factors (Rosenberg 1956; Solomon 2008). These factors can be internal to the individual such as the individual’s knowledge about the product, the individual’s liking of the product, and the intention to buy (Fishbein 1973; Fishbein 2013; Fishbein and Ajzen 1975; Howard and Sheth 1969; Solomon 2008). There can also be factors external to the individual which influence attitude-formation, like the promotional material of firms and the opinion of family and friends (Edell and Burke 1987: 234; Solomon et al. 2013: 123).

The literature on attitude-formation has always focussed on the generic buying behaviour of consumers, with little contribution to attitude-formation towards specific product types, as is the case of renewable energy. Since consumers’ attitudes deter the consumer’s buying of renewable energy, it is imperative to gain a deep understanding of attitudes towards the subject.

The study aims at identifying why Maltese consumers are reluctant to purchase photovoltaic systems, despite diverse government initiatives. The research question which directed the research and the corresponding objectives can be expressed as:

**What are the attitudes of Maltese consumers towards renewable energy?**

The study aims to meet the following research objectives:

- To determine the awareness of Maltese consumers of the benefits of renewable energy;
- To discover the impediments which discourage Maltese consumers from investing in renewable energy;
- To investigate any negative attitudes towards renewable energy;
- To determine the factors which influence consumers’ attitudes towards renewable energy.

The development of theory about attitude-formation for renewable energy will aid policy-makers in drafting more attractive initiatives in their attempt to reach the EU 2020 target. In addition, it will assist the resellers of renewable energy systems to generate demand.

**Grounded Theory Methodology**

In this study, an inductive approach to research was taken with the research methodology based on grounded theory. The researcher adopted an interpretivist research philosophy.
Grounded theory is a qualitative research approach where theory is derived from grounded data which has been systematically gathered and analysed through the research process (Glaser and Strauss 1967: 235). It uses an inductive approach to research where theory emerges from the data gathering and analysis. Grounded theory allows for in-depth insights and understanding (Flick 2012: 145). The comparative analysis involved in the process reduces the bias which characterizes qualitative research (Charmaz 2006: 225).

Five qualitative in-depth interviews were carried out with members of the general public, aged 40 to 55. This age-bracket was selected because it is consumers within this age group who may be prospects to purchase renewable energy systems. Three of the participants do not own a renewable energy system whereas the other two participants do. The interviews were carried out in a semi-structured approach. Semi-structured interviews provided the researcher with flexibility but also with the opportunity to gain in-depth insights of the participants’ opinions about the subject.

Sampling was carried out at three stages. First there was convenience sampling, followed by purposive sampling. In convenience sampling, attention was given to the selection of participants to avoid as much as possible bias, which is considered as the main limitation of this research. Theoretical sampling was required towards the end of the study to reach saturation of properties, which ensured that the full research question was satisfied.

Each interview was digitally recorded, transcribed, and analysed using WEFT software application. This qualitative data analysis software allowed the researcher to analyse and to group the grounded data into contextual conditions, actions and reactions, and consequences and outcomes. Interrelationships between concepts were identified and examined.

**Analysis of the Emerging Constructs**

Since this study makes use of grounded research, it uses a framework of constructs to develop a model of consumers’ attitude formation for renewable energy systems.

The constructs which emerged from the data analysis were placed within a hierarchical structure. Main concepts were identified and lower level concepts were introduced as subcategories by using a top-down approach. The lower level concepts were grouped with the main concepts according to shared properties. This coding model is in line with the work of Corbin and Strauss who introduced this method of coding qualitative data in the ‘Conditional and Consequential Matrix’ (Corbin and Strauss 1998: 205). The hierarchical structure is illustrated in Figure 1. As illustrated by Figure 1, the structure includes three main concepts (the categories) and 22 lower-level concepts (the subcategories). The three main categories are contextual conditions, actions and reactions, and consequences and outcomes.

The contextual conditions category represents factors which influence consumers in their attitudes towards renewable energy systems. The contextual conditions are further grouped into two subcategories: internal factors and external factors. The subdivision into these two subcategories depends on whether the factor is internal to the customer or if it is external to the customer. These influential factors influence the purchase behaviour of consumers for renewable energy systems. This influence constitutes the second main category of constructs, the actions and reactions. These actions and reactions generate consequences and outcomes.
The interrelationships between the three main categories were evaluated. The evaluation indicates that the contextual conditions which influence consumers and trigger the consumers’ buying actions and reactions, which then affect the consequences and outcomes.

The consumer is central in this model because it is the consumer’s attitudes that determine the purchases of renewable energy systems. Attitudes are influenced by the consumers’ characteristics and by factors outside the consumer. The consumer’s characteristics are age, income, occupation, type of house, and knowledge about the environment and about renewable energy. They are factors internal to the customer. The constructs’ evaluation revealed an interrelation among the internal factors influencing the customer.

**Figure 1. The attitudes of Maltese consumers towards renewable energy – emerging constructs**
There is a link between age and knowledge about the environment and renewable energy. Younger customers tend to be more knowledgeable about the challenges being faced by the environment and the benefits of renewable energy. This increases the possibility of such customers having positive attitudes and interest towards renewable energy systems. Income is related to occupation and to the type of house. High-income earners tend to have a higher spending power and large houses, therefore potentially having a positive attitude towards renewable energy systems, financial ability, and an intention to buy.

Interrelationships are among the external factors influencing the customer. Resellers have recognized a consumers’ problem: increasing electricity bills. They have presented renewable energy systems to Maltese customers as a solution to this problem and have positioned the marketing programmes of these systems as a means to reduce electricity bills which render a future investment, rather than a means to safeguard the environment. The negative influence of the high initial cost of these systems has been partly overcome by the government’s grants.

All these influencers which make up the contextual conditions of the model lead to the consumers’ actions and reactions which can be either a positive or a negative attitude. The consumers’ negative attitudes translate into indifference towards renewable energy systems with low involvement in gathering knowledge about renewable energy leading to just a basic awareness of the product.

The positive attitudes formed as a result of the contextual conditions lead to other actions and reactions. A positive attitude towards renewable energy increases consumers’ interest in related products. Their attention to information and promotional material about renewable energy becomes higher (heightened attention). Interested customers involve themselves in information search about renewable energy and form a set of criteria with which to evaluate renewable energy systems offered by different resellers.

Actions and reactions lead to consequences and outcomes. Customers with negative attitudes do not purchase renewable energy systems. Customers with positive attitudes towards renewable energy either purchase these systems or postpone their purchases because of impediments (refer to Figure 2). They may also buy alternative products such as solar water heaters and energy-efficient home appliances.

From the evaluation of the interrelationships between the categories and the subcategories, three different categories of customers for renewable energy systems have been identified. Figure 2 illustrates the three customers’ categories, which are the Indifferent, the Interested, and the Cost-Saver.

**The Indifferent**

This is the customer who has negative attitudes towards renewable energy systems. Because of the lack of interest in the area, this customer group lacks knowledge about the benefits of renewable energy. They do not even consider the reduced cost of electricity as a benefit. The Indifferent has no intention of buying the product.

**The Interested**

This customer group owns positive attitudes towards renewable energy. Since they are interested in this new form of energy, these customers involve themselves in information search and have heightened attention to informative material about renewable energy systems to Maltese customers as a solution to this problem and have positioned the marketing programmes of these systems as a means to reduce electricity bills which render a future investment, rather than a means to safeguard the environment. The negative influence of the high initial cost of these systems has been partly overcome by the government’s grants.

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renewable energy. They possess product awareness and product knowledge. Nonetheless, the study has identified impediments which make these customers to postpone the purchase or to choose alternative products to renewable energy systems (refer to Figure 2).

**The Cost-Saver**

The cost-savers are purchasers of renewable energy systems. They are knowledgeable and aware of renewable energy and its benefits and of related products and systems. This customer group is not necessarily concerned about the environment. They have bought the renewable energy systems for cost-savings motives.

<table>
<thead>
<tr>
<th>The indifferent</th>
<th>The interested</th>
<th>The cost-saver</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Negative attitudes towards renewable energy systems</td>
<td>• Positive attitudes towards renewable energy systems</td>
<td>• Positive attitudes towards renewable energy systems</td>
</tr>
<tr>
<td>• Some knowledge about the benefits of renewable energy</td>
<td>• Knowledgeable about the benefits of renewable energy to purchase the system</td>
<td>• Current or potential customer which a strong intention to purchase the system</td>
</tr>
<tr>
<td>• Aware but indifferent to the problems of fossil fuels</td>
<td>• Aware and alarmed by the problems of fossil fuels</td>
<td>• Not necessarily aware of the problems of fossil fuels</td>
</tr>
<tr>
<td>• No intention to purchase the system</td>
<td>• Intention to buy, but postponed because of impediments</td>
<td>• Not necessarily knowledgeable about the benefits of renewable energy</td>
</tr>
<tr>
<td>• Lack of interest in this product</td>
<td>• The following factors are considered as impediments by these customers:</td>
<td>• Purchase or the strong intention to purchase is spurred by the monetary benefits of renewable energy systems</td>
</tr>
<tr>
<td>• Not even consider the cost benefits of renewable energy</td>
<td>o Insufficient finance</td>
<td>o Positive attitudes towards renewable energy systems</td>
</tr>
<tr>
<td></td>
<td>o The investment takes long to render a return</td>
<td>o Current or potential customer which a strong intention to purchase the system</td>
</tr>
<tr>
<td></td>
<td>o Complicated to use</td>
<td>o Not necessarily aware of the problems of fossil fuels</td>
</tr>
<tr>
<td></td>
<td>o Not needing it now</td>
<td>o Not necessarily knowledgeable about the benefits of renewable energy</td>
</tr>
<tr>
<td></td>
<td>o Structure is cumbersome/ eye soaring</td>
<td>o Purchase or the strong intention to purchase is spurred by the monetary benefits of renewable energy systems</td>
</tr>
<tr>
<td></td>
<td>o Not enough space to install the system</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2. Three categories of consumers for renewable energy systems*
Implications for Stakeholders

The results of the study have various implications for the research stakeholders. The research shows that the formation of consumers’ attitudes towards renewable energy systems is influenced by internal and external factors. The primary internal influencers was the consumers’ financial situation and their knowledge about renewable energy. The main external influencer is the resellers’ product positioning for renewable energy systems.

Consumers’ knowledge about renewable energy and the product positioning of these systems generate interest among customers in this new form of energy. This interest forms positive attitudes but which does not always translate into purchases. The research has identified those impediments which prevents positive attitudes towards renewable energy system from transforming into purchase behaviour. Other consumers with negative attitudes towards renewable energy do not consider cost of energy as an incentive to purchase photovoltaic systems. None of the consumer groups consider the environment in their attitudes towards renewable energy.

Culturally the Maltese own thrift values (Bond 2016). However, government’s financial incentives alone are not enough to generate demand in this new market and to reach the EU 2020 target for renewable energy. Educational campaigns, better housing planning, a review of advertising objectives, and product repositioning concerning the well-being of the environment are measures which can be introduced to reduce purchases impediments.

The Indifferent should be targeted by informative campaigns so that they can be educated about the benefits of renewable energy. These campaigns can be organized by government. Resellers of renewable energy systems may partner in cooperative advertising with the main objective to educate the market. Government and resellers should provide ways to overcome the impediments to the purchase of renewable energy systems which are met by the Interested. Reinforcement campaigns should be developed for the Cost-Savers. Although they are already buyers, this category of customers should not be neglected because their satisfaction with the renewable energy systems will translate into positive word of mouth. Positive word of mouth promotion is the most effective tool for resellers and government alike (Martin and Lueg 2011: 104).

Recommendations for Further Research

This research study is a preliminary investigation into the attitudes of Maltese consumers towards renewable energy. Its results should represent a starting point for further research in the area.

The research can be undertaken using a larger sample. This qualitative research can be complemented with quantitative research. The accuracy of the model in determining attitude formation can be tested using the Fishbein Model (Fishbein 1973) which is widely used to investigate attitude formation in consumer behaviour.

Although it is just a preliminary study, the qualitative value of this research can be enhanced by determining whether the suggested model is applicable to a larger audience. This can be achieved by testing the model in the other small EU member States where penetration of renewable energy is still low. These countries can be Cyprus, Estonia, and Luxemburg which have a penetration of renewable energy...
systems slightly higher than Malta’s (EU Progress Report on Renewable Energy 2017). Malta being the EU member state with the lowest penetration (ibid.). The research should investigate whether consumer attitudes in these countries are influenced by factors like those identified in the Maltese context. The study should also determine the impediments to purchase behaviour for renewable energy systems and compare them to the Maltese scenario.

References


A Coach’s Perception: Major Factors influencing Late Goal-Scoring-Patterns in Maltese Football

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Abstract: Beyond its basic simplicity, football, is a very complex game. There is no one particular way of playing or method of training that can bring about results. The aim of football is to score more or concede fewer goals than the opponent. With goals being the crucial element, statistics prove that a high percentage are scored late in the game.

This study set out to identify and demonstrate that the number of goals scored in the last fifteen minutes of a ninety-minute football game in top football competitions are higher than in any other fifteen-minute segment in the game. The study also investigates the correlation between the highest percentage of late goals and success which is measured as the final placement in the league table. It also attests that the same goal-scoring patterns are relevant to the Maltese Premier Division, which is considered to be at a lower level of play compared to other top leagues. Consequently, the study identifies the main factors which typically influence such goal-scoring patterns as perceived by local coaches. These factors are physiology, technical-tactical elements, and the team’s psychological attitude towards the game, players’ experience, club finances, and unfavourable circumstances which lead to an uneven level of play. Lastly, the paper identifies the different perceptions of these factors based on coaches’ qualifications and coaching experience at senior level.

This paper could assist coaches in planning and preparing training sessions, with the hope of maximizing their training efficiency and effectiveness. It can also assist coaching course-developers and coordinators to enhance the level of the courses by altering content, assessment criteria, and topics.

Keywords: Football; goal-scoring patterns; coaches’ perceptions; experience and qualification.

Analysis of the game of football started as early as the 1950s by Charles Reep (McMahon 2012), a pioneer in performance analysis at a time when the game was very different from today’s. Nowadays professional football clubs conduct independent analyses relating to football, especially using technology with regard to the data captured relating to the game. What was previously considered an advantage is nowadays a necessity if clubs intend to keep up with new developments. Coaches analyse every bit of information to gain that edge which could see them succeed. From video analysis to refined global positioning systems (GPS), technical staff employ every bit of information in order to assess the individual players or the team as a whole (Cummins et al. 2013). However, most of the results and studies carried out exclusively by the top professional football leagues or in top international competitions. There is no evidence that such research was ever conducted in Maltese football.
Modern research and technology relating to coaching is quite vast and concentrates greatly on particular and specialized areas of study, such as physiological elements, tactical strategies, technical elements of the game, and psychology. Whilst these elements are regarded as being fundamental indicators of performance and indicative of developments and trends in training methodologies, there is very limited research on how all these elements impinge collectively on overall performance. It is extremely difficult to actually assess the impact of such elements and to set a weighting for the contributing effect of each separate element on the overall performance. Owing to the very complex nature of team sports, it is very difficult if not impossible to scientifically assess the impact of each individual factor’s influence on results and goals scored. As a matter of fact, much of the scientific analysis done is usually driven by an individual element acting on its own, such as a physiological and biomechanical approach or a tactical element resulting in goals scored. Such analysis can identify the effect of one particular element such as shots on target resulting in goals, or whether a particular type of training improves aerobic or anaerobic conditioning, but it cannot analyse the elements collectively to determine the possibility of scoring a goal. Analysis of tactical performance in team sports remains an under-theorized field, since there is very limited scientific research undertaken to identify which factors are key to underpinning performance (Garganta 2009). There are insufficient and sometimes even conflicting conclusions which attempt to demonstrate and quantify the influence of each element on the overall result or possibility of a goal scored.

**Literature Review**

**Tactical and Technical Determinants of Goal-Scoring Opportunities**

Kite and Nevill (2017) have researched the relationship between number and type of shots and passes which led to goals. This study concluded that, although most goals scored are through organized offensive moves (88%) and fewer through counterattacks (12%), the success percentages of each, indicate that counterattacks are more effective, because 16.9% of them lead to a goal, whereas only 11.1% of organized play lead to a goal. According to an analysis of goal-scoring patterns in the 2012 European football championships, 72.4% of goals came from open play, which includes counterattacks, whilst the remaining 27.6% of goals came from set pieces. Of the goals coming from open play, 56.6% came from attacks initiated in the attacking half, whilst 43.4% of goals came from the defending half. It was also noted that 52.6% of goals started from the central area, although it does not mean that the final delivery came from area. As a matter of fact, most goals (43.7%) came from crosses (Aramatas et al. 2014).

The study also states that 61.84% of goals came from a team possession of four passes or less. Whilst these figures go give some insight, they do not give a sufficient explanation of where the attacks leading to these goals with so few passes started. Perhaps a clearer and more exact explanation would help in understanding better how counterattacks could be most effective (Michailidis et al. 2013). The ball won in the ‘defending half’ could have come from interceptions (such as clearance of crosses) deep in the half or from interceptions/tackles on the halfway line. Determining the most prolific areas would give an indication as to where a team should prepare their defence and attempt to reconquer the ball in order to launch an attack (Yiannakos and Armatas 2006).
Physiological Determinants of Goal-Scoring Opportunities

Many studies have delved into seeking the relationship between football performances and physiology. High intensity running is a fundamental aspect of football. The distances covered during a game and the speed of running are dependent on the position of the player on the field. It has been noted that teams in the top five positions within a league run less (885 +/- 113m) than teams in the bottom five positions (919+/- 128m). This could indicate that running more is not correlated with winning. The top teams ran relatively less, thus suggesting that higher technical and tactical levels could be more important than physiological elements to achieve results (Di Salvo et al. 2009). Therefore, it would be imperative to understand the major physiological determinants which influence the opportunities of scoring goals, especially late during the game. Studies indicate that there are a number of physiological aspects which are necessary to perform optimally. Mujika et al. (2009) carried out research on tests that were carried out to assess the physical demands of football for both men and women:

- Vertical jumping;
- 15 m sprinting;
- 15 m agility run;
- 15 m ball dribble;
- Yo-Yo intermittent recovery test level 1.

Table 1: Field tests performance (Mujika et al. 2009):

<table>
<thead>
<tr>
<th>Variable</th>
<th>Senior Males</th>
<th>Junior Males</th>
<th>Senior Females</th>
<th>Junior Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yo-Yo IR1 (m)</td>
<td>2,414 +/- 456</td>
<td>2,092 +/- 260</td>
<td>1,224 +/- 255</td>
<td>826 +/- 160</td>
</tr>
<tr>
<td>CMJ (cm)</td>
<td>43.7 +/- 2.2</td>
<td>43.9 +/- 4.8</td>
<td>32.6 +/- 3.7</td>
<td>28.41 +/- 1.99</td>
</tr>
<tr>
<td>ACMJ (cm)</td>
<td>50.1 +/- 4.2</td>
<td>51.8 +/- 4.8</td>
<td>38.0 +/- 4.8</td>
<td>33.1 +/- 2.7</td>
</tr>
<tr>
<td>Sprint 15m (m/s)</td>
<td>7.16 +/- 0.21</td>
<td>7.17 +/- 0.22</td>
<td>6.30 +/- 0.24</td>
<td>6.17 +/- 0.17</td>
</tr>
<tr>
<td>Agility 15m (m/s)</td>
<td>5.14 +/- 0.25</td>
<td>4.89 +/- 0.14</td>
<td>4.55 +/- 0.25</td>
<td>4.22 +/- 0.21</td>
</tr>
<tr>
<td>Ball 15m (m/s)</td>
<td>3.82 +/- 0.22</td>
<td>3.79 +/- 0.32</td>
<td>3.41 +/- 0.32</td>
<td>3.04 +/- 0.21</td>
</tr>
</tbody>
</table>

The better results obtained in the Yo-Yo test indicate that a high level of intermittent endurance is needed to perform at the highest level (Mujika et al. 2009). This might be seen as conflicting with the above findings. However, it could mean that to make it to the highest levels a player needs to be at the top of every aspect of the game. The differences indicated in the Yo-YoIR1 performance have been reported to depend on training status, period of the season, and explosive strength of the lower limbs in male players (Castagna et al. 2006; Krstrup et al. 2003). This is further strengthened by the fact that change of direction, also referred to as agility, is influenced by the combination of explosive strength, balance, muscular coordination, and flexibility (Sheppard & Young 2006). One can conclude that explosive strength influences both endurance and agility, two very important physiological elements in the game. Several studies have evidenced that agility performance should be regarded as an independent physiological element in football (Buttifant et al. 2002; Little & Williams 2005; Wisløff et al. 2004). As a result, it should be considered a physiological requirement for football performance.

Psychological Determinants of Goal-Scoring Opportunities

Another indicative element for goals scored late is the psychological component. The motivation to obtain a result or the fear of conceding could affect the playing style.
and induce defenders to more mistakes. Taking the risk to go for a goal could mean that the attacking team could actually concede a goal because their defensive line is exposed to quick counterattacks. This risk could be due to a team being under and necessitates taking a risk to score in order to draw level or obtain a better goal average. Psychologically a team which is not urgently seeking to score can lie deep and be patient, thus tempting the opponents to open vulnerable space in their defensive third.

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Football is a sport were only few goals are scored in a game. As a result, scoring the first goal in a match may be very important in obtaining a win. It was identified that in the Greek superleague during the season 2006–07 teams which scored the first goal, won 71.43% of their matches (Armatas et al. 2009). The same phenomenon was evident in the professional Spanish football league from the 2005–06 to 2009–10 seasons when 74.47% of matches were won by the team that scored the first goal (Pratas et al. 2016). Mental strength, focus, and concentration are all psychological aspects which can make a difference between obtaining a needed result and failing to reach targeted objectives. Many teams collapse in crucial matches or periods of a season. A clear example of this would be the taking of penalty kicks in the penalty shootout at the end of a game which requires a declared winner. Geir et al. (2007) studied 41 penalty shootouts and 409 kicks taken in the World Cup, European championships, and Copa America between 1976 and 2004. They established that the importance of the kicks (indicative of stress) was negatively related to the outcomes of the kicks, whereas skill and fatigue were less, or not, related to outcome. It was concluded that psychological components are the most significant element when the stakes are high. The same components add pressure on teams trying to score a much-needed goal,
yet when the opportunity comes begging in the dying minutes of the game, players fumble and squander the chance.

Another psychological aspect of football which has been given less attention is that of setting specific targets for both individual players and the team. Whilst it is nowadays accepted that psychology plays a very important part in football, it is still not given the same importance in its practical application. This might be due to the culture within the game and the fact that football is a very old game which was always managed in its entirety by the coach. Recently the introduction of the physical trainer was an indicator that things might change and that it has become recognized that one person cannot specialize in all areas, especially in a professional set-up. Research has shown that players find it very difficult to set their goals strategies (Johnson et al. 2011; Larsen et al. 2013). A lack of proper goal-setting strategies can lead to a reduced capability of achieving. By merely setting a target, a club would not add to its chances of obtaining results. Players and teams must be guided continuously by a sports psychologist. Literature makes it very clear that psychology is a very important aspect in sport, but the lack of qualified psychologists employed by clubs and the fact that top clubs have only recently started to invest in sports psychologists indicate that this area is not given its due attention.

Financial Determinants on Goal-Scoring Opportunities

Beyond the elements of the game inside the field of play, Garfjell Fløtnes (2011) have demonstrated that there exists a clear relationship between success and the financial status of the club. The important factors for success observed through the analysis of this study are player wages and financial resources measured through operating income. Menear (2018) has identified the top ten European club based on annual revenue as at December 2017:

Table 2: Top 10 European Clubs - Annual Revenue (December 2017)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Club</th>
<th>Annual Revenue ($Mln)</th>
<th>Net Value ($Bln)</th>
<th>Champion’s League Winners*</th>
<th>Champion’s League Runners-up</th>
<th>Domestic League Winners (last 10 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manchester Utd</td>
<td>765</td>
<td>3.689</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Real Madrid</td>
<td>688</td>
<td>3.580</td>
<td>13</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Barcelona</td>
<td>688</td>
<td>3.635</td>
<td>5</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Bayern Munich</td>
<td>657</td>
<td>2.713</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>PSG</td>
<td>578</td>
<td>0.841</td>
<td>Nil</td>
<td>Nil</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Arsenal</td>
<td>520</td>
<td>1.932</td>
<td>Nil</td>
<td>Nil</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Chelsea</td>
<td>497</td>
<td>1.845</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Liverpool</td>
<td>448</td>
<td>1.492</td>
<td>5</td>
<td>3</td>
<td>Nil</td>
</tr>
<tr>
<td>9</td>
<td>Juventus</td>
<td>379</td>
<td>1.258</td>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>Tottenham</td>
<td>310</td>
<td>1.05</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

*Winners between 1956 and 2018

As these clubs’ revenues and significant achievements indicate, these clubs have dominated their domestic leagues and also European football. The salaries for Barcelona top the list at €372m, whilst Manchester United have a wage roll of €321m and Real Madrid €307m. All the other teams above are amongst the top 10 salary payers with the exception of Tottenham Hotspur who sit at 14th place in European football (De La Riva 2018). This indicates that income directly affects salaries and, as a result, correlates to success. In fact, five teams from England are amongst the top
earners and payers, yet Tottenham, Arsenal, and Liverpool have won very little owing to the competition by the other English teams in the league.

**Age and Experience Determinants on Goal-Scoring Opportunities**

Age and experience are two other elements which are mutually dependent in more than one way. Relative age experience has a high effect of younger players, to the extent that the players born earlier in the year tend to have a higher physical, emotional, and cognitive awareness than those born later in the year. Salinero et al. (2013) have demonstrated that Relative Age Effect (RAE) is influential in European professional football, particularly Italy, France, and Spain. Helsen et al. (1998) discovered that those footballers born in the last months of the year gave up the sport at an early age as a result of not making the team. Whilst really talented players manage to make the team, Ford et al. (2008) concluded that there was no relative age effect on them; however, results indicated that, when technical or tactical skills are equal, a greater physical capacity can be determining. Physical capacity has been proven to be superior in children born in the early months of the year. The study also concluded that defenders and midfielders are the most affected by relative age.

Whilst the above is true for youth football, the relative age effect might level out by the time players reach senior football. However, age and experience could still have an influential effect on player selection, because clubs which feel obliged to win or be extremely competitive prefer to acquire a player who is considered ‘ready’ for competition. According to a number of studies, players tend to peak between the ages of 25 and 27. This confirms the same interpretation given above that players playing in certain positions peak at different ages. Subsequent to this age-bracket, players start to decline in terms of physiological conditioning and consequently in performances. Arsenal, under their long-standing coach Arsene Wenger, had taken an unofficial stand to offer players over 30 years only a one-year contract extension because they felt that after this age players do not retain high standards of play (Kuper and Szymanski 2009). Similarly, Sir Alex Ferguson has stated that players peak between 24 and 28 (Ferguson 2013). This coincides with the fact that in the 2014 World Cup, a tournament which brings together the best and most in-form players at the time, the average age for all 32 teams was 27.5 years. Studies indicate that a one-year increase in the average age of 27.5 years, relates to a 4-place drop in performance (The Economist 2014). Attackers peak at the age of 27 whilst midfielders peak slightly earlier at 26. Defenders achieve their peak at 27, but their peak range extends from 24 to 29 (Dendir 2016).

**Goal-Scoring Patterns**

The aim of football is to score more or concede fewer goals than the opponent, making goals the crucial element in the game. Statistics show that a high percentage of goals are scored late in the game (Soccerstats.com, 2017). This is seen consistently in all the top six European football leagues, in the top Brazilian and Argentinean football leagues, as well as the lower English leagues which are of a similar level to Maltese football.

The table below indicates the number and percentage of total goals scored for every fifteen-minute interval during a full season (2017–18) for the Argentinean Premera, the Italian Serie A, the Spanish La Liga, and the English Premier League which are considered to be amongst the top leagues worldwide.
held in Portugal in 2004, more goals were scored in the second half (57.4%) than in the first (42.6%).

This phenomenon was even confirmed by Njororai (2014) who confirmed the same pattern of goal-scoring. This paper indicated that the scoring peak was the 76–90 minutes period, with 1,093 goals (21.73%) scored, followed by the 61st–75th minutes with 1,024 goals (20.7%).

Table 3: Goals Scored for higher level divisions – 15 Minute intervals

<table>
<thead>
<tr>
<th>Country</th>
<th>Minutes</th>
<th>Goals</th>
<th>% Goals</th>
<th>Goals</th>
<th>% Goals</th>
<th>Goals</th>
<th>% Goals</th>
<th>Goals</th>
<th>% Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>0–15</td>
<td>124</td>
<td>14.5</td>
<td>122</td>
<td>12.0</td>
<td>119</td>
<td>11.6</td>
<td>119</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>16–30</td>
<td>124</td>
<td>14.5</td>
<td>161</td>
<td>15.8</td>
<td>156</td>
<td>15.2</td>
<td>147</td>
<td>14.4</td>
</tr>
<tr>
<td></td>
<td>17–45</td>
<td>129</td>
<td>15.1</td>
<td>166</td>
<td>16.3</td>
<td>161</td>
<td>15.7</td>
<td>161</td>
<td>15.8</td>
</tr>
<tr>
<td></td>
<td>46–60</td>
<td>133</td>
<td>15.6</td>
<td>170</td>
<td>16.7</td>
<td>167</td>
<td>16.3</td>
<td>170</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>61–75</td>
<td>137</td>
<td>16.0</td>
<td>186</td>
<td>18.3</td>
<td>171</td>
<td>16.7</td>
<td>191</td>
<td>18.8</td>
</tr>
<tr>
<td></td>
<td>76–90</td>
<td>207</td>
<td>24.2</td>
<td>212</td>
<td>20.8</td>
<td>250</td>
<td>24.4</td>
<td>230</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>1st half</td>
<td>377</td>
<td>44.1</td>
<td>449</td>
<td>44.1</td>
<td>436</td>
<td>42.6</td>
<td>427</td>
<td>41.9</td>
</tr>
<tr>
<td></td>
<td>2nd half</td>
<td>477</td>
<td>55.9</td>
<td>568</td>
<td>55.9</td>
<td>588</td>
<td>57.4</td>
<td>591</td>
<td>58.1</td>
</tr>
<tr>
<td>Total</td>
<td>854</td>
<td>1017</td>
<td>1024</td>
<td>1018</td>
<td>1024</td>
<td>1018</td>
<td>1024</td>
<td>1018</td>
<td>1024</td>
</tr>
</tbody>
</table>

The following table indicates the number and percentage of total goals during the 2017–18 season in the English League One, English League Two, the English National League, and the Maltese Premier league. The latter three English competitions are similar in level to the Maltese Premier League and hence they are being grouped together. Besides the top leagues in the world, the study gathered goal-scoring patterns relevant to the Maltese Premier Division in terms of timing of goals scored. Owing to a difference in the level of play between the top leagues and the Maltese Premier Division, the research aimed to identify similar patterns with international leagues. Data indicates that this goal-scoring pattern is also applicable to the Maltese Premier League for season 2016–17. All data relating to local statistics was provided by Lennard Kelder – social media engagement officer at the Malta Football Association.

Table 4: Goals Scored for lower level divisions – 15 minute Intervals

<table>
<thead>
<tr>
<th>Country</th>
<th>Malta</th>
<th>English League One</th>
<th>English League Two</th>
<th>English National league</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td>Goals</td>
<td>% Goals</td>
<td>Goals</td>
<td>% Goals</td>
</tr>
<tr>
<td>0–15</td>
<td>75</td>
<td>13.23</td>
<td>188</td>
<td>13.4</td>
</tr>
<tr>
<td>16–30</td>
<td>74</td>
<td>13.05</td>
<td>191</td>
<td>13.6</td>
</tr>
<tr>
<td>17–45</td>
<td>99</td>
<td>17.46</td>
<td>230</td>
<td>16.4</td>
</tr>
<tr>
<td>46–60</td>
<td>89</td>
<td>15.70</td>
<td>242</td>
<td>17.3</td>
</tr>
<tr>
<td>61–75</td>
<td>98</td>
<td>17.28</td>
<td>229</td>
<td>16.3</td>
</tr>
<tr>
<td>76–90</td>
<td>132</td>
<td>23.28</td>
<td>321</td>
<td>22.9</td>
</tr>
<tr>
<td>1st half</td>
<td>248</td>
<td>43.74</td>
<td>609</td>
<td>43.5</td>
</tr>
<tr>
<td>2nd half</td>
<td>319</td>
<td>56.26</td>
<td>792</td>
<td>56.5</td>
</tr>
<tr>
<td>Total</td>
<td>567</td>
<td>100.0</td>
<td>1401</td>
<td>100.0</td>
</tr>
</tbody>
</table>

This phenomenon was even confirmed by Njororai (2014) who confirmed the same patterns of goal-scoring. This paper indicated that the scoring peak was the 76–90 minutes period, with 1,093 goals (21.73%) scored, followed by the 61st–75th minutes with 894 goals (17.77%). A similar study revealed that in the European championships held in Portugal in 2004, more goals were scored in the second half (57.4%) than in the first (42.6%) (Yiannakos and Armatas 2006).
A close relationship between late goals scored and the final position of the teams in their respective leagues. In Germany, Bayern Munich are the team that scored most goals in the last 15 minutes during the 2017-18 season - 21 goals. Paris St Germain rank 1st in both the final league classification and in terms of late goals scored within the last 15 minutes - scored 31 goals and conceded nine, whilst in Italy, Juventus are ranked 2nd in terms of goals scored in the last 15 minutes - 18 goals and conceded only 3 goals, the least in the Serie A. In England the team which won the league, Manchester City scored 25 goals in the last 15 minutes and conceded only five, whilst Manchester United which came second, both in the final league classification and in the goal scored within the last 15 minutes table, scored 18 goals and only conceded four. Tottenham Hotspur which ended the league in third place, scored 15 goals within the last 15 minutes and conceded 10 goals. Similarly, Liverpool FC ended the league in fourth place and they are the third most prolific team in terms of most goals scored in the last 15 minutes with 17 goals in favour but 12 conceded.

Table 5: Goals Scored and Conceded during the last 15 Minutes vs Final League ranking (Soccerstats 2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>Club</th>
<th>Goals scored last 15 min</th>
<th>Goals Conceded last 15 min</th>
<th>Goal diff. last 15 min</th>
<th>Better diff. last 15 min</th>
<th>League table final ranking</th>
<th>Point Diff. from next classified</th>
<th>Late diff from next classified</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>Manchester City</td>
<td>21</td>
<td>5</td>
<td>16</td>
<td>1*</td>
<td>1*</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Manchester United</td>
<td>18</td>
<td>4</td>
<td>14</td>
<td>2*</td>
<td>2*</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Tottenham Hotspur</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>Joint 4*</td>
<td>3*</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Liverpool FC</td>
<td>17</td>
<td>12</td>
<td>5</td>
<td>Joint 4*</td>
<td>4*</td>
<td>5</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>Chelsea FC</td>
<td>13</td>
<td>7</td>
<td>6</td>
<td>3*</td>
<td>5*</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Arsenal FC</td>
<td>16</td>
<td>11</td>
<td>5</td>
<td>Joint 4*</td>
<td>6*</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>France</td>
<td>Paris St. Germain</td>
<td>31</td>
<td>9</td>
<td>22</td>
<td>1*</td>
<td>1*</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Germany</td>
<td>Bayern Munich</td>
<td>21</td>
<td>3</td>
<td>18</td>
<td>1*</td>
<td>1*</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Juventus FC</td>
<td>18</td>
<td>3</td>
<td>15</td>
<td>1*</td>
<td>1*</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Spain</td>
<td>Barcelona FC</td>
<td>26</td>
<td>2</td>
<td>24</td>
<td>1*</td>
<td>1*</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Atletico Madrid</td>
<td>10</td>
<td>11</td>
<td>-1</td>
<td>9*</td>
<td>2*</td>
<td>3</td>
<td>-10</td>
</tr>
<tr>
<td></td>
<td>Real Madrid</td>
<td>22</td>
<td>13</td>
<td>9</td>
<td>Joint 3*</td>
<td>3*</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>

The above table indicates that the teams which score most in the last 15 minutes are the teams that also ranked higher in the final league classification.

**Research Methodology**

**Design**

Following extensive research and literature review, it was decided that the best method of enquiry to be adopted for this study would be through a quantitative approach wherein a number of local coaches would be asked to participate in a questionnaire. Subsequently, through the use of SPSS, the findings were recorded and analysed.

The primary aim of the study was to identify the perceptions of coaches coaching senior football teams in Malta in relation to which main factors contribute to late
goals scored. Given that no previously used questionnaires regarding the factors influencing late goals were available, one was developed for this particular research. The questionnaire developed was based on the above literature review referring to the factors which led to better performances and results. As indicated in the literature review section, a number of components act simultaneously and independently to affect performance and results, which are consequently related to late goals scored. Statistics confirm that the number of goals scored, and particularly late goals, are a major factor in team performances and results. Since most goals are scored late in the game, it was interesting to identify the perceptions of coaches as to which factors led to late goals. These indicators were then used to develop the questionnaire for this study. The questionnaire was then passed on to the director of the technical centre and the director of coach education at the Malta Football Association to confirm its validity. Suggestions to add particular items were discussed and, following discussions, several of the proposed alterations were adopted.

The questionnaire was prepared and sent out to coaches through Google Forms either through their Facebook account or through their email. The collected data was converted to an Excel sheet coded, and tested for reliability using the Cronbach’s Alpha test. The results scored a satisfactory 0.881. The final questionnaire, which included 40 items, emanated through the coaches’ demographics and the literature review. The Bartlett’s test of sphericity was then carried out and a significance of .000 was recorded. It must also be noted that, under certain circumstances, the coaches’ demographics were not equally distributed. In some instances, this was because the number of coaches coaching senior football in Malta is quite limited. In other instances, it was due to normal distributions, such as the fact that very few coaches between the ages of 18 and 25 are appointed to coach senior teams. The same applies for coaches over 66 years of age. A Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was carried out, resulting in an index of 0.578 which, although not ideal, is considered acceptable especially since it denotes an almost 100% of the population. Because of the relatively low sampling size, the ratio of variables to participants was not within suggested parameters.

Subsequently, since the questionnaire included a high number of items (n=40) to obtain the coaches’ perspective, it was deemed necessary to reduce these items to make them more manageable and understandable. Using Factor Analysis through SPSS, a Principal Component Analysis was carried out using the Direct Oblimin rotation method. Since the component correlation matrix indicated that there was no real correlation (loading all below 0.32), it was decided to use Varimax as a rotation method. The total variance indicated that nine components had an eigenvalue of 1 or more, with a cumulative percentage of 76.573%. However, on investigating the scree plot, it was decided to recalculate using between five and to nine components. Ultimately only five components were adopted for extraction providing a cumulative percentage of 60.498% which produced a stronger structure. Initially, coefficients lower than 0.3 were suppressed to eliminate any insignificant values, yet ultimately this was set at 0.5. Furthermore, three items were removed from the rotated component matrix since they were giving multiple loadings and the intent was to clearly identify each item for every individual component selected. These omitted components were team formation, ball possession, and intrinsic motivation. Following a final run, for each of the five components, the strongest factor loading ranged between .839 and .773, whilst the weakest loading for each component ranged between .615 and .506.

‘Ball possession’ was deemed to be non-influential by coaches across board, irrespective of independent factors. This also confirms statistics and studies which
indicate that possession is not a precursor to success. The same conclusion regarded ‘team formation’. Results indicate that the team formation does not impinge on the coaches’ perception to achieve a better return on goals scored late. Furthermore, since ‘intrinsic motivation’ loaded quite low on two different components, it was decided to remove this item as well. As a result, the rotated component matrix provided a stronger and clearer structure.

Participants

The participants were all male coaches, since there are no women coaching male senior teams. The majority of coaches were active senior team coaches during the 2017–18 season. Since some coaches did not reply, even following a number of attempts, it was decided to include a similar number of currently inactive coaches with similar experiences. There are currently fifty-three senior teams in Malta and for this research forty coaches participated.

Data captured took into consideration the coaches’ perception based on their age, qualifications (licence obtained through the Malta Football Association), experience (overall coaching experience and experience coaching senior male teams), and their highest level of coaching (division coached). The study aimed at understanding whether these particular demographics influence the coaches’ perceptions in relation to late goals scored. Coaches’ qualifications and experience influence their methodology and training philosophy which could also lead to better performance (Leite et al. 2011); however, the study also aimed at understanding whether there are any differences in the coaches’ perceptions based on these particular demographics. The five components, together with the coaches’ demographics, were then analysed to carry out a one-way ANOVA in order to identify such differences. Levene’s test for homogeneity of variance was carried out. In all tests between the dependant and independent variables, except when testing by coaches’ age against the dependant variables, there resulted no statistically significant difference in the variance between groups and thus a null hypothesis can be confirmed. Since only one participant for each of the 18–25 and 66+ age groups participated, results exhibited a statistical significant difference in variance between groups. For this comparison only, both these groups were omitted in order to conduct Welch and Brown-Forsythe tests, both of which produced a P-value of 0.597 and 0.676 respectively. Since the Levene’s test indicated that the assumption of homogeneity of variance was violated for the different age groups in relation to physiology, the Games-Howell test was conducted. This test was also conducted since the sample size was not equal for each group. Results are analysed in the analysis of results section.

Analysis of Results

Secondary research clearly confirms that, in all the major leagues studied, the highest percentage of goals are realized in the last 15 minutes of the game, thus making this a crucial time in a football match. This is also applicable to lower leagues, such as League One, League Two, the English National League, and the Maltese Premier League. Whilst it cannot be stated that there is an exact correlation between goals scored/conceded late in the game and final position in the league table, there exists a very close relationship between both parameters. It can be safely stated that consistently scored late goals leads to success. In fact, the first classified teams in England, Germany, Italy, France, and Spain also had the best positive difference between goals scored and goals conceded during the last 15 minutes of the game. Only in two situations (Liverpool FC vis-à-vis Chelsea FC and Atletico Madrid vis-
à-vis Real Madrid) did a better classified team score worse on late goal difference. This goes to demonstrate that late goals are a very important aspect in the clubs’ performance and results.

When analysing the data through Principal Component Analysis within SPSS, the final components were very clearly indicative of the same elements identified in the literate review. These components were identified as:

**Physiological component:** This includes all elements which make up the athletic components of the game namely, speed including reaction time, aerobic and anaerobic endurance, strength, agility, balance and coordination, explosive power, nutrition and lifestyle, and adequate recovery/rest between training sessions of different intensities and games. It also includes the ability of players to concentrate and focus during the late part of a game.

**Technical-tactical component (including the psychological element):** These elements include the individual technical abilities of the players and the tactical interpretations of the players individually and as a team. It also includes the mentality of the players and the team and the willingness to take higher risks, which are also part of the tactical approach in a game and the team cohesion which is an interdependent component of the tactical base.

**Club financial strength:** This element includes the amount of wages paid by the club when compared to competitors and the clubs’ income or net worth.

**Player experience:** This element includes the players’ maturity level based on their life experiences, ability to control stress, and their experience at a certain playing level. Both experiences are identified separately in the study since they are distinct from one another. A relatively young player with little life experience can have a relatively high experience at playing crucial games at top level.

**Unfavourable circumstances:** This includes situations which puts one of the teams at a disadvantage over the opponents. They include playing in inferiority because of a red card or playing below full potential following an injury to a starting player forcing a substitution.

It is important to note that, whilst those items relating to the psychological elements had strong influences on the coaches’ perceptions, they were not distinct from the tactical and technical items and were therefore grouped under the same component. This is also quite interesting since the psychological elements and the technical-tactical elements could be perceived by coaches as being interdependent. In fact, a decision to make an audacious substitution in the final minutes of the game can be perceived as a tactical decision to push forward, but also a psychological one as the coach and the team have a winning mentality.

A One-way Anova was carried out to understand the differences between the different groups based on qualifications, experience, and highest division coached. Results indicate that there was no significant difference between the groups when comparing the independent components based on the coaches’ qualification.
Table 6: ANOVA between different coaching qualifications and dependant variables

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.653</td>
<td>3</td>
<td>.884</td>
<td>.376</td>
<td>.463</td>
</tr>
<tr>
<td>Within Groups</td>
<td>36.347</td>
<td>35</td>
<td>1.010</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>technical-tactical &amp; Psychological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>1.770</td>
<td>3</td>
<td>.590</td>
<td>.570</td>
<td>.638</td>
</tr>
<tr>
<td>Within Groups</td>
<td>37.230</td>
<td>35</td>
<td>1.034</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Player Experience and Form</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.109</td>
<td>3</td>
<td>.703</td>
<td>.586</td>
<td>.566</td>
</tr>
<tr>
<td>Within Groups</td>
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<td>35</td>
<td>1.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Club Wealth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>1.472</td>
<td>3</td>
<td>.491</td>
<td>.471</td>
<td>.705</td>
</tr>
<tr>
<td>Within Groups</td>
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<td>1.042</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<tr>
<td>Unfavourable Circumstances</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>1.755</td>
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<td>.598</td>
<td>.599</td>
<td>.639</td>
</tr>
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<td>Within Groups</td>
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<td>1.034</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results indicate that there was no statistical significant difference between the groups when comparing the independent components based on the coaches' overall experience, yet a statistical significant difference was elevated when considering the coaching experience at senior-team level, for the technical-tactical and psychological factor between groups. The test of homogeneity of variance does not indicate any statistically significant difference.

Table 7: ANOVA between overall coaching experience and dependent variables

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<td>Physiological</td>
<td></td>
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</tr>
<tr>
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<td>Within Groups</td>
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<td>39</td>
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<td>Within Groups</td>
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</table>
Table 8: ANOVA between experience at coaching senior team level and dependent variables

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<th>Variable</th>
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<th>F</th>
<th>Sig.</th>
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<td><strong>Physiological</strong></td>
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<td>Within Groups</td>
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<td><strong>Technical-Tactical &amp; Psychological</strong></td>
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<td>Between Groups</td>
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<td><strong>Player Experience and Form</strong></td>
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<td></td>
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<td>Between Groups</td>
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<td>1.212</td>
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<td>Within Groups</td>
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<td><strong>Club Wealth</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>6.930</td>
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<td>1.733</td>
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</tr>
<tr>
<td>Within Groups</td>
<td>32.070</td>
<td>35</td>
<td>.915</td>
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<tr>
<td><strong>Unfavourable Circumstances</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
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<td>.283</td>
<td>.887</td>
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<td>Within Groups</td>
<td>37.780</td>
<td>35</td>
<td>1.079</td>
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</tbody>
</table>

Results indicate that there was a statistically significant difference between certain groups when comparing the independent component of unfavourable circumstances based on the coaches’ highest division coached. On conducting a Games-Howell test, the significant difference lay mainly between the perceptions of coaches coaching in the first and second divisions in relation to unfavourable circumstances. On all the other four components, there was a very high similarity in perceptions among all coaches. However, coaches coaching at third division have the largest variance when compared to the other three groups, particularly on the technical-tactical components. A Welch test was conducted to further investigate the statistical significance among groups.

Table 9: Robust Tests of Equality of Means

<table>
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<th>Variable</th>
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<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiological</strong></td>
<td>2.893</td>
<td>4</td>
<td>7.806</td>
<td>.096</td>
</tr>
<tr>
<td><strong>technical-tactical &amp; Psychological</strong></td>
<td>2.297</td>
<td>4</td>
<td>7.377</td>
<td>.154</td>
</tr>
<tr>
<td><strong>Player Experience and Form</strong></td>
<td>1.218</td>
<td>4</td>
<td>7.265</td>
<td>.381</td>
</tr>
<tr>
<td><strong>Club Wealth</strong></td>
<td>2.766</td>
<td>4</td>
<td>7.602</td>
<td>.107</td>
</tr>
<tr>
<td><strong>Unfavourable Circumstances</strong></td>
<td>.787</td>
<td>4</td>
<td>8.601</td>
<td>.563</td>
</tr>
</tbody>
</table>

a. Asymptotically F distributed.

Vol. 2, Issue 1, 2018
Results indicate that there was a statistically significant difference between certain groups when comparing the independent component of unfavourable circumstances based on the coaches' highest division coached. On conducting a Games-Howell test, the significant difference lay mainly between the perceptions of coaches coaching in the first and second divisions in relation to unfavourable circumstances. On all the other four components, there was a very high similarity in perceptions among all coaches. However, coaches coaching at third division have the largest variance when compared to the other three groups, particularly on the technical-tactical components. A Welch test was conducted to further investigate the statistical significance among groups.

Table 10: ANOVA between experience at coaching higher divisions

<table>
<thead>
<tr>
<th>Component</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.852</td>
<td>3</td>
<td>951</td>
<td>.947</td>
<td>.428</td>
</tr>
<tr>
<td>Within Groups</td>
<td>38.149</td>
<td>36</td>
<td>1.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>technical-tactical &amp; Psychological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>5.122</td>
<td>3</td>
<td>1.707</td>
<td>1.814</td>
<td>.182</td>
</tr>
<tr>
<td>Within Groups</td>
<td>33.878</td>
<td>36</td>
<td>.941</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Player Experience and Form</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3.561</td>
<td>3</td>
<td>1.187</td>
<td>1.206</td>
<td>.322</td>
</tr>
<tr>
<td>Within Groups</td>
<td>35.439</td>
<td>36</td>
<td>.984</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Club Wealth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.163</td>
<td>3</td>
<td>.721</td>
<td>.705</td>
<td>.556</td>
</tr>
<tr>
<td>Within Groups</td>
<td>36.837</td>
<td>36</td>
<td>1.023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfavourable Circumstances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>9.974</td>
<td>3</td>
<td>3.325</td>
<td>4.123</td>
<td>.013</td>
</tr>
<tr>
<td>Within Groups</td>
<td>29.026</td>
<td>36</td>
<td>.806</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.000</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11: Robust Tests of Equality of Means

<table>
<thead>
<tr>
<th>Component</th>
<th>Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological</td>
<td>Welch</td>
<td>1.387</td>
<td>3</td>
<td>11.582</td>
</tr>
<tr>
<td>technical-tactical &amp; Psychological</td>
<td>Welch</td>
<td>1.511</td>
<td>3</td>
<td>11.106</td>
</tr>
<tr>
<td>Player Experience and Form</td>
<td>Welch</td>
<td>1.379</td>
<td>3</td>
<td>11.990</td>
</tr>
<tr>
<td>Club Wealth</td>
<td>Welch</td>
<td>.760</td>
<td>3</td>
<td>10.071</td>
</tr>
<tr>
<td>Unfavourable Circumstances</td>
<td>Welch</td>
<td>3.377</td>
<td>3</td>
<td>12.005</td>
</tr>
</tbody>
</table>

a. Asymptotically F distributed.
Further to these tests conducted through SPSS, the study intended to find out which components were most highly perceived as influential based on the coaches’ qualifications and experience working with senior teams. Through working out the average for each component, it has been observed that coaches irrespective of their qualification believe that club finances and unfavourable circumstances have no influence at all on late goals scored, whilst physiology and player experience do have some positive influence. However, the technical-tactical and psychological element was deemed to have a strong influence on the late goals scored. It is interesting to note that despite the different levels of qualification there is very little difference between the perceptions of coaches to these components.

Table 13: Coaches’ perceptions to factors influencing late goals based on their Qualifications

<table>
<thead>
<tr>
<th>Component</th>
<th>Average</th>
<th>Closest Likert scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiology</td>
<td>5.1</td>
<td>5</td>
<td>Some positive influence</td>
</tr>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>5.5</td>
<td>5–6</td>
<td>Some positive influence – strong positive influence</td>
</tr>
<tr>
<td>Player experience</td>
<td>5.0</td>
<td>5</td>
<td>Some positive influence</td>
</tr>
<tr>
<td>Club finances</td>
<td>3.5</td>
<td>3–4</td>
<td>Some negative influence – no influence at all</td>
</tr>
<tr>
<td>Unfavourable circumstances</td>
<td>4.5</td>
<td>4–5</td>
<td>No influence at all</td>
</tr>
</tbody>
</table>

When the same averages were calculated based on the coaches’ experience working with senior male teams, the results indicated a different scenario. All coaches tend to perceive physiology as having some positive influence on the late goals scored. However, more experienced coaches perceive the technical-tactical and psychological elements as being strongly influential to late goals scored, whilst the least experienced coaches conceive these elements as being of some positive influence (refer to table below). With regards to late goals being influenced by the unfavourable circumstances and clubs’ financial stability, all coaches irrespective of experience deem these to have no influence at all. Player experience was believed to be of very little influence to late goals by the majority of inexperienced coaches, whilst the highly experienced coaches believe that experience can have a relatively strong influence on late goal-scoring.
Table 14: Coaches’ perceptions to factors influencing late goals based on their Experience

<table>
<thead>
<tr>
<th>Component</th>
<th>Experience</th>
<th>average</th>
<th>Closest Likert scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>1–3 yrs</td>
<td>5.17</td>
<td>5</td>
<td>Some positive influence</td>
</tr>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>4–6 yrs</td>
<td>5.96</td>
<td>6</td>
<td>Strong positive influence</td>
</tr>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>7–10 yrs</td>
<td>5.82</td>
<td>6</td>
<td>Strong positive influence</td>
</tr>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>11–14 yrs</td>
<td>5.59</td>
<td>6</td>
<td>Strong negative influence</td>
</tr>
<tr>
<td>Technical-Tactical and Psychology</td>
<td>15+ yrs</td>
<td>6.02</td>
<td>6</td>
<td>Strong positive influence</td>
</tr>
</tbody>
</table>

Conclusions

Since late goal-scoring patterns are unequivocally visible in all the top leagues, the results provide a platform which could be exploited by local coaches when planning their training sessions. Understanding that late goals are correlated to winning and success, more attention should be given to exploit the physical, tactical, and mental demands during the last 15 minutes. Similarly, experienced players can be an asset during this delicate time of the game. Through these results, one can conclude that, overall, Maltese coaches consider the technical-tactical and psychological elements as having an influence of the effect of late goals, yet experienced coaches tend to believe that this element can be a very strong influence. Likewise, coaches believe that physiology and player experience can slightly impinge on late goals, with the more experienced coaches giving these elements a slightly higher ranking compared to their less experienced colleagues. The study should provide an insight to the lesser-experienced coaches when planning and preparing their training sessions, with the hope of maximizing their training efficiency and effectiveness bearing in mind that sessions should contain a higher commitment to the mental preparation and the technical and tactical awareness of individual players and the team as a whole.

These results should also provide the technical centre and coaches’ education department at the Malta Football Association with an insight about coaches’ perceptions based on various qualifications and experiences. Whilst no significant difference can be noted between coaches of different qualifications, experience indicates a difference in perceptions. Could courses be conducted on a longer span? Should they include modules of job-shadowing sandwiched between content and assessment? This could provide the course coordinators food for thought in order to enhance not only the level of the courses by altering the content and assessment criteria but to also bridge the gap between knowledge and experience.

References


A COACH’S PERCEPTION: MAJOR FACTORS INFLUENCING LATE GOAL-SCORING-PATTERNS IN MALTESE FOOTBALL


The Economist 2014. ‘Player age in football: The clock is ticking’, 4 July.


Typing Biometrics as a Form of Passive User Authentication

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frankie.inguanez@mcast.edu.mt
*Institute of Information And Communication Technology, MCAST

Abstract: With the increase in the popularity and technology of smartphones, a rise in theft and cyber-crime is also being noted. The most popular forms of active authentication are limited to simply unlocking access to the device and do not cater for the possibility of an intruder getting hold of the device whilst unlocked. In this research a form of passive continuous authentication, which uses the owner’s typing signature to continuously authenticate the user, is being proposed. This research has extended to also cater for a combination of the individual being stationary, walking, or using one or two hands. The classifier created achieved an accuracy of 99%. With this research MCAST IICT is able to demonstrate that sensitive data on smartphones can be secured with an elevated level of security. Since it is desirable to encourage future researchers to build on this research, it has been decided to publish the data gathering prototype on GitHub, the dataset gathered on Kaggle and results in this paper.

Keywords: Keystroke dynamics; biometric; machine learning; passive user authentication.

Introduction

Smartphones are the most popular device of modern age, packed with personal, billing, and corporate information as well as being one of the easiest to lose or to have stolen or compromised. Since the initial attempts to secure smartphones in 2008, various measures have been introduced, mostly focused on active forms of authentication such as pin codes, pattern swipes, passwords, and, most recently, technologies with dedicated hardware such as fingerprint recognition and facial recognition (De Luca and Lindqvist 2015). Touch ID and Face ID by Google and Apple flagship products, with dedicated hardware and an excellent accuracy, have gained mainstream popularity but have increased the price of smartphones. The motivation of keystroke dynamics research in smartphone technology is to find a cost-effective secure manner of authenticating users without the need of dedicated hardware but at the same time having a similar high accuracy level. The need of continuous passive modes of authentication for devices with very sensitive data, such as those belonging to politicians, intelligence officers, or bank employees, are further motivations for this research. The main forms of activity on smartphones are typing, gestures, or swiping usually associated with navigation, as well as hyper activity mostly during gaming. Analytical research in gestures is relatively novel and gaining popularity (De Luca and Lindqvist 2015; Frank et al. 2013). After a combined research of 2 years, it has been established that the initial barriers to researching this area are two-fold: the lack of an extensive dataset and the lack of an open-source smartphone application to gather data. For this reason the developed application has been published on GitHub and the dataset generated on Kaggle. This paper also presents the results of the classifier.
Literature

Recent research demonstrate that smartphones have become ubiquitous across all demographics and countries (Berenguer et al. 2017) with varying uses across different age groups. The balance of usability and security require that authentication is generally limited to unlocking the device rather than to access different applications and/or sites. This practice presents a number of issues, namely having a singular point of failure should the pin/password/pattern be compromised by observations (Kita et al. 2013), or if the device left unattended and an intruder gains access before being locked out. Research has shown that sharing of personal devices is common practice (Karlson et al. 2009) and this has led to various lawsuits, such as in parental control issues, namely the lawsuit against Apple Inc. after iPhone users were billed for acquisitions done by their children (Wyatt and Chen 2014). Muslukhov et al. (2013) has shown that insiders are more likely to intrude than strangers, thus posing the greater risk. A case in point is the six-year-old girl who unlocked her mother’s phone using her thumb whilst asleep, then proceeding to buy a total of $250 in Pokemon content (Stevens 2017). Corporate data is also at risk, as happened in the 2013 attack on Target, where 40 million customers and 70 million personal users had their data stolen (Upton and Creese 2014). The uniqueness of the keystroke was discussed as early as the nineteenth-century (BioPassword 2006) with the initial research publication in 1980 (Gaines et al. 1980) and a gradual increase in interest as documented in Shanmugapriya and Padmavathi (2009). Use of secondary features were explored in Sun et al. (2017) using a Support Vector Machine (SVM) and achieved an Equal Error Rate (EER) of 2.94%. Use of acoustic key clicks, also using SVM, achieved an accuracy of 92.8% by Zhou et al. (2016). An extensive survey about research in the area highlights the use of Artificial Neural Networks, Support Vector Machines, Fuzzy Logic, and other techniques for keystroke dynamics (Banerjee and Woodard 2012). The initial research made use of Neural Networks and achieved an EER of 5% (Inguanez and Ahmadi 2016). This was not as accurate as research using other pattern recognition methods such as support vector machines which achieved an EER of 0.41% (Lee and Cho 2007). The lack of a standard was such that a proposed format for keystroke dynamic data interchange was highlighted in Banerjee and Woodard (2012) who also did a review of available datasets which are being summarized in Table 1. The type refers to the use of static (S) versus dynamic (D) use of terms.

Table 1. Available Datasets

<table>
<thead>
<tr>
<th>Database</th>
<th>Type</th>
<th>Subjects</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montalvao Filho and Freire 2006</td>
<td>S</td>
<td>32</td>
<td>320</td>
</tr>
<tr>
<td>Killourhy and Maxion 2009</td>
<td>D</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td>Giot, El-Abed, &amp; Rosenberger 2009</td>
<td>S</td>
<td>133</td>
<td>7,555</td>
</tr>
<tr>
<td>Allen 2010</td>
<td>S</td>
<td>104</td>
<td>2,379</td>
</tr>
<tr>
<td>Bello, Bertacchini, Benitez, Pizzoni, &amp; Cipriano 2010</td>
<td>S</td>
<td>54</td>
<td>282,020</td>
</tr>
</tbody>
</table>

Methodology

Having decided to create a smartphone app and generate the dataset, the first decision to be made was to decide on the target OS. Based on various research, it was evident that the Android OS would be ideal (Gartner 2018). The next challenge was the limited stock keyboard, since it does not allow access to gather touch information. From previous research (Inguanez and Ahmadi 2016), it was noted that the keyboard design should follow modern standards/styles since otherwise it would take a while
for users to get used to it; a new one (Figure 1) based on Black (2016) has been developed.

![Custom Keyboard](image)

**Figure 1. Android App: Custom Keyboard**

When designing the smartphone application, it was necessary to have the flexibility to have different user typing activities, such as using one or two hands, being stationary, or moving. Other research might want to explore different forms of activities so this list can be easily modified through an enumerator class `TypingMode.java`. The application allows the local registration of a user; this way a user who wants to repeat the test can use a previously created account. Apart from the unique alias and email, some demographics are stored per user: age, gender, and handedness. Upon registering, user details are saved in the same file named `users.json`; this file is loaded every time the application starts. In addition to the user’s file, two more important files are created on the first run of the application. First, `deviceinfo.json` which stores information about the smartphone, namely Android device id; manufacturer; model; OS name & version; and screen width and height. The second file, `keyboardinfo.json`, stores the primary code, x, y position, width, height, and character of every keyboard key. The application was designed so that the text to be typed by the user is split in a number of sentences which can be defined by the researcher in a file named `sentences.json`. Since the application does not force the user to type the exact text, a researcher can opt to use the application for free text as well. The user then chooses a typing activity: the first sentence is listed and, every time a user presses the done key, the next sentence is displayed. All the sentences are looped, whereupon on finishing the last one they are taken to the save session data screen where all data is stored in a JSON file prefixed with the text session and containing the email of the participant together with a timestamp to avoid having any files saving over each other. To make sure all data was saved and never lost during typing activities, a synchronous approach was used in the implementation which would not allow multiple touch data overriding each other owing to typing’s fast nature, while a counter parameter was added to be truly sure keys were saved after each other properly. After a typing session was finished, a timer was also implemented to check that every last bit of data from the activity was saved before allowing a new activity to be performed. It is noted that the migration tool and data analysis code are not part of the published application but rather only the data gathering Android application is. With this application, one can visualize the various typing patterns of different users and identify initial differences, such as the x, y key hit positions of two different users as shown in Figure 2.

The application consists in requesting a user to type an illustrated sentence, without checking for typing errors. It had to been ensured that the requested terms are
well-known and do not require the user to refer to the illustrated text regularly but rather to recall it from memory. In choosing the terms a lemmatized list off the British National Corpus from research by Kilgarriff (1997) was used. The most frequent terms were chosen so that every letter in the English alphabet is listed at least three times. Since it was intended to consider pair and triplet key combinations, in order to find digraph and trigraph time latencies, it was necessary to identify the most frequent key combinations both for pairs and triples to ensure that they match the lemmatized list, which are listed in Table 2.

![Figure 2. Contrast of different typing X, Y hit positions (inguanez and Ahmadi 2016)](image_url)

**Table 2. Top Pairs and Triples Comparison**

<table>
<thead>
<tr>
<th>Top English Terms</th>
<th>Chosen terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pairs</strong></td>
<td><strong>Triplets</strong></td>
</tr>
<tr>
<td>t h</td>
<td>t h e</td>
</tr>
<tr>
<td>e r</td>
<td>e r t</td>
</tr>
<tr>
<td>h e</td>
<td>e v c</td>
</tr>
<tr>
<td>i n</td>
<td>v e r</td>
</tr>
<tr>
<td>o u</td>
<td>t h i</td>
</tr>
<tr>
<td>a l</td>
<td>h o u</td>
</tr>
<tr>
<td>c a</td>
<td>a l l</td>
</tr>
<tr>
<td>a n</td>
<td>h i n</td>
</tr>
<tr>
<td>s l</td>
<td>i n g</td>
</tr>
<tr>
<td>v c</td>
<td>t h o</td>
</tr>
</tbody>
</table>

Twenty-four persons used the app, with a total of 187 typing sessions and 186,825 key events. One user represented the owner of the smartphone and generated 50% of the data. The dataset being published contains the following features: Session id – session identifier; user id – user identifier; is right handed – 1 if user is right-handed, 0 otherwise; mode name – Typing mode name; start time – Starting time of session in milliseconds; end time – Ending time of session in milliseconds; primary code – Typed key primary code; character – Typed key character; start x position – Key start x position; end x position – Key end x position; width – Key width in pixels; height – Key height in pixels; time – Time key was pressed in milliseconds; x position – x position of touch event; y position – y position of touch event; is down – 1 if key is pressed, 0
otherwise; counter – Iteration number of key event. Using the provided data, a number of features can be created such as digraph & trigraph time latencies, slide distance, and velocity. A digraph time latency is the time difference from one key stroke to a second as depicted in Figure 3, whilst a trigraph refers to the time latency whilst hitting three consecutive keys. This research supports the use of adding statistical values and the importance of not providing unnecessary features since these can affect the model being created, as per Mendes (2017). In this research the creation of digraph and trigraph time latencies within a timeframe of 500 milliseconds was undertaken, since it was noticed that in some cases participants paused for rest or reading or were distracted.

![Figure 3. Digraphs Time Interval Features (Inguanez and Ahmadi 2016)](image)

During the research experiments, a number of observations were made and feedback was gathered which shall be noted. Each participant had four activities to perform; it was noticed that, in most cases, during the first activity the participants were hesitant and overly cautious, whilst in the subsequent activities their typing pattern picked up speed. Therefore, it is being recommended that for future research participants are given a trial before starting the actual test. This research had some participants with small hands and had found it challenging to type on the Samsung S5 device (5.1” display) with one hand. It is recommended that more research is carried out on using keystroke dynamics as a form of authentication across devices with a different screen size. Even though a few left-handed individuals where covered in this research, they all typed using their right hand, leading the researchers to believe that the handedness is irrelevant. During the data analysis it was noticed that the handedness did not have any statistical relevance. There were many typing mistakes, leading to an excessive use of the backspace key and overly cautious typing. Some participants reported that they usually have auto-correct and thus do not usually bother to type correctly. The choice of keyboard was praised since it was very similar to what they already have on their personal devices, which is a great improvement over the one used in Inguanez and Ahmadi (2016). One participant notified us that he was used to SwipeKey which is a keyboard that supports swipes instead of the traditional typing action, thus he was not typing at his normal rhythm.

With this application and generated dataset, this research was able to create a Support Vector Model (SVM) that would successfully classify the owner of the smartphone from intruders with an equal error rate ranging from 0.44% to 1.42% for different modes...
of activity. This research created multiple datasets, per activity mode (stationary vs. moving), per handedness (single vs. both), per n-graph count (digraph vs. trigraph), resulting in a total of 18 different datasets. Based on other research it was evident that statistical features needed to be added (Monrose et al. 2002; Inguanez and Ahmadi 2016), so this research explored different approaches on which to base the mean, median, and standard deviation calculations. This research has established that the ideal statistics should be on the touch features, namely (x, y) position, slide distance, and slide velocity.

After determining the ideal SVM structure for each dataset, this research has established that the best results are given using trigraphs on datasets with statistical features calculated per sentence typed. The results vary from 0.44% to 1.42% for different activity modes, as shown in Table 4, which compare very well to similar research by Crawford and Ahmadzadeh (2017). In this research one can observe the misclassification for digraphs and trigraphs in Figures 4 and 5.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Recall</th>
<th>FAR</th>
<th>FRR</th>
<th>EER</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>96%</td>
<td>96%</td>
<td>97%</td>
<td>4%</td>
<td>3%</td>
<td>3.93%</td>
</tr>
<tr>
<td>Moving</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>1%</td>
<td>2%</td>
<td>1.60%</td>
</tr>
<tr>
<td>Stationary</td>
<td>99%</td>
<td>98%</td>
<td>98%</td>
<td>1%</td>
<td>2%</td>
<td>1.33%</td>
</tr>
<tr>
<td>Two Hands</td>
<td>99%</td>
<td>98%</td>
<td>99%</td>
<td>1%</td>
<td>1%</td>
<td>1.04%</td>
</tr>
<tr>
<td>One Hand</td>
<td>99%</td>
<td>99%</td>
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Figure 4. Digraph Misclassification Scatter Graph

Figure 5. Trigraph Misclassification Scatter Graph
Table 3: Final Digraphs Results for Sentence-Based Datasets Dataset

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Table 4: Final Trigraphs Results for Sentence-Based Datasets Dataset

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Conclusion

After researching the use of keystroke dynamics in smartphones, it was concluded that this is surely a cost-effective solution which can strengthen active modes of authentication, such as pin codes and passwords, yet it can also be used in passive modes of authentications. A possible scenario would be to have a dedicated smartphone app for access to corporate data and messaging system which uses a dedicated virtual keyboard and thus an elevated level of security. Adoption of keystroke dynamics across the entire use of a smartphone has not been researched enough and might be excessive; it has also been noted that life events could render this level of security non-practical. Since there should be a balance between practicality and security, it is being recommended that keystroke dynamics are used to enforce the traditional forms of authentication such as pin codes and password, as well as being used in a tailor-made application for corporate use. For this reason, it is recommended that further research into the following potential hypotheses is undertaken:

- A user’s typing model can be migrated from one smartphone to another even of different screen size;
- A different typing model must be adopted for landscape vs. portrait use;
- Changes to the handling (due to artificial nails, injury) of a smartphone;
- Use of acoustic key clicks, also using SVM;
- The typing model needs to be retrained if the keyboard layout and/or size changes;
- Prolonged use of the same keyboard would improve the user’s proficiency thus requiring a change of the user model;
- A typing pattern can be emulated;
- The swiping pattern as a form of typing can also be used as a form of authentication.
By having an open-source publicly available smartphone prototype and public dataset, researchers can focus on their research hypothesis and perform initial research quickly; thus it is hoped that these resources will be found useful.

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Wyatt, E. and Chen, B.X. 2014. ‘Apple to refund app store purchases made without...

The Impact on Education of Children Admitted into Care after Experiencing Abuse

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Abstract: This study focuses on the impact of abuse on the child’s education while it explores how these children are being supported in care institutions to minimize and overcome the effects of abuse on their educational journey.

This paper starts by determining the need for this study, the definition of child abuse and then explores the effects of child abuse on the child’s behavioural and psychological well-being. This is supported through different studies where the effects of child abuse on the child’s academic level are looked into. Support from the legal aspect is examined as well as the support being given on the management’s behalf in children homes.

A qualitative approach was adopted through eight semi-structured interviews with residential social workers and/or heads of care from different children homes. The concept of validity and reliability were examined by referring to the concept of credibility which referred to believability or reasonableness; dependability which referred to the description of the changes that occur during the course of research and an understanding of how such changes affect the study; transferability which referred to the ability to generalize, or the extent to which the results of the research can be applied to other settings or contexts (Trochim 2006: 1); and conformability which referred to the degree to which participants agree or corroborate with the research findings in contrast to the preferences and characteristics of the researcher (Guba Guba’s 2018: 197–250).

The thematic analysis of the data concluded that most children in care have a low educational level although a few were not affected in their education. A child’s coping mechanisms and resilience play an important role to overcome the effects of abuse. It is important that a holistic support system is provided within the home as well as coordination between the home and educational institutions.

This study concludes that children who have experienced abuse and were admitted in care need to be supported with a care plan which establishes reachable targets to promote a better opportunity for the child to have a positive educational experience. A number of these children choose not to continue tertiary education owing to their urge of becoming independent.

The conclusion looks into the recommendations for more measures to be incorporated, particularly within the educational institution, as well as the need for better holistic support system between the school and the home through a policy which directly supports the education of children in care.
**Keywords:** Residential care; social worker; management; child abuse; children who experienced abuse; education.

Statistics published in 2016 showed that 207 children are living in residential homes, which is a high number considering Malta’s demographics. There is also little understanding of the struggles that children in care deal with on a day-to-day basis in terms of their educational experience (MacGillivray 2010: 92). In fact, although there have been several researches conducted worldwide regarding the effects of child abuse, little research has been conducted on the impact that child abuse may have on the individuals’ education.

**Literature Review**

It is perceived that the future of children who suffered abuse and are admitted in care is ruined. This study adopts the World Health Organization’s (WHO) definition of child abuse, namely that Child maltreatment is the abuse and neglect that occurs to children under 18 years of age. It includes all types of physical and/or emotional ill-treatment, sexual abuse, neglect, negligence and commercial or other exploitation, which results in actual or potential harm to the child’s health, survival, development, or dignity in the context of a relationship of responsibility, trust, or power’ (WHO 2018: 1).

Research indicates that all forms of child abuse tend to affect a child’s wellbeing through adverse psychological effects. Since abuse is in itself a trauma, some children develop post-traumatic stress disorder (Katz & Barnetz 2014: 40) while others may experience other effects, which range from chronic low self-esteem to severe dissociative states (Child Welfare Information Gateway 2013). Researchers, including Drotar (1992) and Katz and Barnetz (2013: 1033), claim that, while abuse would have harmed the development of attachment and bonding between a child and a parent, this may impact their ability of problem solving, of building social relationships and of coping with new stressful situations (Child Welfare Information Gateway 2013).

On the other hand, when it comes to the behavioural aspect, research indicates that some children may experience withdrawal or avoidance behaviour while others may experience fear, anger and aggression (ibid.). While some children who experience abuse might end up bullying others, as they would feel powerful once they are away from the perpetrator, there are times when the individual might end up becoming a victim of bullying (ibid.).

Research shows that with regards children who have been admitted in care, after experiencing abuse, are at a disadvantage educationally when compared to mainstream students (Abela 2012), including poor academic achievement (Gilbert et al. 2009; Mills 2004; Veltman and Browne 2001: 68–71). Veltman and Browne’s meta-analysis (2001: 215) determines that 31 out of 34 studies indicated poor school performance because of abuse and neglect while Wolfe (1999) states that 36 of 42 studies indicated language delays.

These children may also experience a wide range of effects which range from attention problems to learning disorders (ibid.). Several studies have concluded that there is a fair consistency in problematic school performance because these children perform poorly in standardized test scores, gain frequent retention in grade and achieve low grades (Gilbert et al. 2009; Mills 2004; Veltman & Browne 2001: 215).
Veltman and Browne’s study correlates to a local study conducted by the Commissioner for Children (2012) that obtained repetitive results regarding the academic profile of 154 participants admitted in care, owing to various reasons, such as neglect. Results show that, irrespective of the type of placement, children in care perform poorly in the three main subjects: English, Maltese and Mathematics (Commissioner for Children 2012: 23–33). In addition, Johnson, Browne and Hamilton-Giachritsis (2006) claim that, apart from performing poorly in the three main subjects, children who have gone through abuse may have language developmental delays along with less spontaneous language and poorer vocabulary.

When it comes to the support which is given from the legal aspect, the Education Act 1991 only refers to how an educational professional should deal with the suspicion of child abuse. It states that one should inform the principal who in turn will inform the child protection services for investigation (Government of Malta, 1991). This is directly stipulated within the Education Act (1988: 26) as: ‘It is clearly the duty of the State to ensure that in reference to suspicion or disclosure of child abuse, normal referral procedures shall be referred to (Part IV).’

Eventually this claim abides to the European Convention on Human Rights where, ‘Everyone has the right to respect for his private and family life, his home and his correspondence (Article 8).’

The above claims deliver the message that in case of suspicion of child abuse it is important to treat the case with individualization as at this stage there has to be clear examination of the case. At this stage support services must be adjusted to accommodate the needs of the situation. The wishes and desires of the child should be respected at all times as it is further essential that a professional should know the boundaries of his role. This is because at this stage the child would have started facing the reality of the situation, which he might have been hiding it for a long time, with someone ready to listen and understand the current situation (Galea 1999: 20–6). Thus, as it is important not to cause any potential harm to the well-being of the child such as with flashbacks when he is expressing his experience; abiding to the above claims helps prevent interference of professional boundaries while providing holistic support (Child Welfare Information Gateway 2013).

Support has even been incorporated in policies. In 2014 the Ministry for Education and Employment implemented a set of policies to support children in their education, including those in residential homes although this was not being stated in these policies. This was part of the Framework for the Education Strategy for Malta 2014–24. One of these policies is the Respect for All Framework (2014) which aims to provide a safe, secure and motivating environment where the child can express himself (Ministry for Education and Employment 2014). Another policy is Addressing Bullying Behaviour in School (2014) which aims to protect the vulnerability of children from ending up victims or bullies themselves (Ministry for Education and Employment 2014). These policies clearly indicate an era of change and improvement in the educational system. Although these policies are not directly targeted for children who are in care after undergoing abuse, they reflect the reality that some of these children face. A clear example is that some children who have experienced abuse and are placed in residential care as a result might end up victims of bullying owing to their vulnerability with coping with their traumatic experience.

These policies indicate an element of professional direction along with clear understanding of how these children should be supported to facilitate their integration.
within the school environment while not exposing their vulnerability in front of others. These policies are meant to help these children not to recall their traumatic experience within the school environment. If one experiences challenging behaviour at school, for example, professionals are directed on how to handle the situation in the best way possible.

Change was also incorporated in the way children’s homes function in their day-to-day operation. The management of children’s homes started by incorporating a Personal Education Plan (PEP) where every child admitted in care is provided with a care plan which is an integral part of the support given to them to cope with their situation (Manchester City Council 2018). The need for providing every child with a PEP is beneficiary as it is a statutory tool which ensures that every professional involved in the child’s case is actively prioritizing his education by carefully tracking his overall progress and supporting him holistically to achieve and be aspirational during his educational journey (ibid.). As the PEP is an evolving record of what needs to happen for looked-after children, to enable them to fulfil their potential while making the expected progress, this plan is made available to the school to ensure a holistic follow-up (Schembri 2016: 3–20). Moreover, as the PEP is reviewed and updated every six months, it requires the residential social workers, designated teachers, carers and other relevant professionals to join together to analyse and determine areas for improvement. The use of this strategy between the school and the residential home is effective since a clear guideline of how to act is established; it helps ensuring that educational needs are met, while aspirations are supported to help these children look positively at their future (Department for Education – UK 2014: 14–29). Locally, the use of the PEP requires every progress between the school and the home and vice-versa to be recorded and reported. This promotes a structured build-up coordination of work which helps the child to perform better educationally. Research indicates that providing a holistic system rather than a split one helps binding the PEP in a way that meets the needs of the child in a stabilized manner as there is a holistic consistency (Ministry for Education & Employment 2017). Additionally, the PEP is also used when coordinating Supervised Accessed Visits (SAVs) where the management collaborates with the child welfare agency to determine how family contact would affect the child in his education.

Research also shows that an in-house educational plan has been incorporated within children’s homes to improve the academic support which is offered to these children (Cove Care 2015: 1). This plan is developed after an initial assessment is done for every child admitted in care as this helps to determine the basis of the child’s education report and provides information to develop strategies to support his educational inclusion (ibid.). Such a personal educational plan would be used to develop an in-house educational plan where an educational coordinator from the Education Department is assigned to that particular residential home and would be responsible to maintain contact between the tutors who give numeracy and literacy lessons, the school and those professionals caring for the child within the home. In addition, while the coordinator’s aim would be to improve and empower the child’s academic achievement, importance would be given to contain the child’s behaviour (Schembri 2016: 3–20). This is because they might be dealing with children who cannot sit down in class while they are aggressive; through this support plan coordinators could plan how the child should behave towards other classmates to follow up school lessons (MacGillivray et al. 2010: 92–384).

Eventually, the support plan will prove beneficiary since, as child-support services promote the use of a multi-disciplinary approach, management is obliged to implement
and observe that all individualized care plans are outlined in monthly scheduled plans to ensure that all key aspects are met. Research indicates that the most striking thing about abused children is their ability to survive and thrive in the future despite the trauma they would have experienced (Underwood 2016: 76). As a result, the care environment should be supportive to help these children enhance their resilience. Consequently, children’s homes should aim to stabilize their experience through creating a friendly family environment rather than an institutional environment (ibid.).

Research Design

For the purpose of this study, qualitative research was chosen over quantitative research. Since qualitative research is primarily exploratory research (DeFranzo 2011:1), this approach was adopted as the researcher was looking into the experience of what it means to go through abuse while one is still attending compulsory education. It also helped the researcher to look further into the quality of educational support being provided to these children. Through this type of research, a researcher can gain an understanding of the underlying reasons and opinions about the subject; such research also provides insights into the problem and/or may even lead towards developing new ideas for future research (ibid.).

After adopting a qualitative research, semi-structured interviews were chosen as a research tool. McCammon (2010: 382) states that semi-structured interviews are used in research to enable the researcher to make an ‘identification of the insights into an issue presented from the perspective of participants or end-users’ (ibid.). Semi-structured interviews also offer a balance between the flexibility of an open-ended interview and the focus of a structured ethnographic survey (Rubin 2005: 1).

Different sampling techniques were used to select the participants. Purposive sampling was adopted as a technique, where the researcher had to rely on his own judgment when choosing participants (Saunders 2012: 1). Participants were selected after contacting different children’s homes and informing them regarding the purpose of this study and asking them if the residential social work/head of care was willing to share his experience on working with victims of child abuse, by participating in an interview. The first eight participants who were willing to be interviewed and who came from different children’s residential homes were selected as this was an advantage since different methods and approaches used within these different homes to support children in their education could be examined.

Additionally, judgmental sampling was also used as participants were chosen only if they had experiences with working with children admitted in care after experiencing abuse. This means that one’s own level of knowledge and professional experience played an important role in ensuring this study’s validity.

Any issues that may have arisen while collecting data were taken into account. Before every interview, an information letter explaining the aspects of this research, such as the procedures to be followed prior, during and after collection, as well as other important information was given to the interviewees.

A consent form was also given to all participants to ensure that they were provided with sufficient detailed information on the study so that they could make an informed, rational and voluntary decisions whether to participate. Here the researcher was abiding to confidentiality as both the information letter and consent form served as a source protector.
Permission for recording was also granted by the participants so that the researcher could dedicate his full attention to the participant. This helped in transcribing every interview conducted to ensure that visually no important detail was left out.

After the data was gathered, thematic analysis was used to ensure that data was organized and described in detail (JYU 2016). Using thematic analysis meant that this research followed six phases to create established, meaningful patterns.

Table 1: Source: University of Auckland 2018

| Phase 1 | Familiarizing  
|         | Transcribing data, reading and re-reading the data, jotting down initial ideas. |
| Phase 2 | Generating initial codes  
|         | Coding interesting features of the data in a systematic fashion across the entire data set, collecting data relevant to each code. |
| Phase 3 | Searching for themes among codes  
|         | Collecting codes into potential themes, gathering the data relevant to each potential theme. |
| Phase 4 | Reviewing themes  
|         | Checking the themes application in relation to the coded extracts (level 1) and the entire data set (level 2), generating a thematic "map" of the analysis. |
| Phase 5 | Defining and naming themes  
|         | Ongoing analysis to refine the specifics of each theme, and the overall narrative by the analysis; generating clear definitions and names for each theme. |
| Phase 6 | Write-up  
|         | The final phase involves weaving together the analytic narrative and data extracts, and contextualising the analysis in relation to existing literature. |

Once transcripts were completed, the researcher started questioning himself to familiarize himself to the data gathered. This led to coding where the researcher highlighted the most relevant information with regards to the study (Boyatzis 1998: 1) to helped prevent the mixing of data as some coded data had been collected together (Renee 2016). Coding occurred in two phases where first the portion of data to be coded during the first cycle coding processes ranged from a single word to full paragraphs of text (Strauss 2008: 3–7). In the second cycle, the previously coded portions were joined together in units which resulted in the development of reconfiguration of the codes (ibid.). Coding data helped capturing the topics being
referred to, which eventually helped in the next step of sorting codes into potential themes and categories (Renee 2016). This was done through the use of mind maps where everything was kept sorted into particular components. These components helped to maintain accurate records. These ensured that this study was addressing its aim as the researcher was asking himself whether the intentions regarding raising awareness on the impact of abuse on the child's education were being adhered.

The researcher ensured to be ethical in his considerations. To ensure that no moral harm would be caused, participants had to participate on a voluntary basis. While permission was acquired through the authorization of the organizational home directors, the researcher also abided with the organization/agency regulations as well to the MCAST’s regulation policy. Here it was essential to protect the interviewees, the organizations that the interviewees was representing, as well their service users, so that the source of information would not be identified.

Finally, throughout the whole study the concept of reliability and validity was confined to by making direct references to the work of Gibbs (2007). Gibbs developed the idea that, for qualitative validity, the researcher must check the accuracy of the findings by employing certain procedures (ibid.).

As regard qualitative reliability, Gibbs indicates that the researchers’ approach should be consistent across different researchers and different projects (ibid.). This section looks into how reliability and validity were addressed in this study by looking at the concept of credibility, dependability, transferability and conformability.

Credibility refers to believability or reasonableness (Guba Guba’s 2018: 197–250). It involves understanding the phenomena that the research findings are found to be reliable and accepted by the different realities being studied since the participants are the ones who can legitimately judge the credibility of the results (Trochim 2006: 1). On the other hand, dependability is the description of the changes that occur during the course of research and an understanding of how such changes affect the study (Guba Guba’s 2018: 197–250). Transferability is the ability to generalize or the extent to which the results of the research can be applied to other settings or contexts (Trochim 2006: 1). Bowen argues that transferability shows that there is a degree of similarity where findings are applicable to other contexts (Bowen 2011: 1). Conformability is the degree to which participants agree or corroborate with the research findings in contrast to the preferences and characteristics of the researcher (Guba Guba’s 2018: 197–250).

In relation to Gibbs’ theoretical framework, it was important for the researcher to identify his prejudice, research bias and experiences at the start of the study. This was done to enhance objectivity as the researcher was then capable of carrying out the study without any judgmental attitude and assumptions.

Another strategy adhered to was that an external person with experience in working with children in care but with no connection to the study was contacted and explained the purpose of this study. She was responsible to review and check whether the findings, interpretations and conclusions in the study supported the data provided in the beginning. The literature review was then compared to the findings gathered during data collection as well to the evaluation of this study as established in the conclusion.
Finally, it was important that, prior to conducting the interviews, participants were informed that there were no correct answers. This meant that participants felt confident in expressing their experiences and opinions thus enhanced their honesty. For the purpose of the next section, the original direct quotes which emerged from the findings are written on the left-hand side in italics (Maltese quotes), whilst the English translation is presented on the right-hand side.

**Analysis of Research Findings**

The following is a qualitative data analysis where themes that emerged are analysed in the vision of national and international studies concerning children who have gone through abuse.

**Child Educational Level**

A good educational level is today considered an essential aspect towards prospect future opportunities. Findings show that children who have gone through abuse may have this opportunity adversely affected. In this regard, literature has proven that there are several repercussions for a child who underwent abuse. As these ranges from psychological effects to behavioural problems, this means that focusing on education would not be a priority (Katz & Barnetz 2014: 41). Veltman and Browne’s (2001: 39) meta-analysis study indicates that most children who would have experienced abuse are negatively affected in their education as they claim that 91% of such children had poor school achievements. In congruence with the above study, participants argued that upon admission in care, the child’s educational level was generally found to be below the mainstream.

‘Ħafna drabi tfal li jkunu għaddew minn abuse u jkunu ġew admitted in care, il-livell ta’ edukazzjoni taghhom ma tkunx wahda ta’jba.’ (Participant 2)

‘Most of the time, children who would have gone through abuse and were admitted in care as a result wouldn’t have a good level of education.’ (Participant 2)

‘In ġenerali ma tkunx għolja ħafna. Ikun hemm tfal li they stand out; però din tkun fil-minoranza.’ (Participant 8)

‘In general it wouldn’t be very high. There would be children who stand out; however these would be in the minority.’ (Participant 8)

It is evident from the data that the effects that abuse would have left on the child’s well-being may impact his ability to reach the norm success within the educational institution.

Personality, resilience and coping mechanisms play a vital role towards overcoming the effects of such traumatic events. Literature claims that not every child who experiences abuse is negatively impacted (Jaffee et al. 2004: 44–55). Some children have a strong personality, a good sense of humour and a strong intellect/active imagination which helps them to minimize the impact of abuse on their well-being (ibid.).
‘Gieli kellna tfal li ghalkemm ghaddew minn abbuż, xorta kienu mħajrin li jitgħallmu. Kien hemm tfal li l-iskola kienet tinteressahom u kont tarhom jaqraw u jistudjaw.’ (Participant 2)

‘We have had children who, although they would have undergone abuse, were still motivated to learn. There were children who were interested in school and you could see them reading and studying.’ (Participant 2)

‘Meta it-tfal ma jkunux affettwatti dik turik li tkun ġejja ħabba ir-resilience għax it-tfal ikollhom ċertu inner strengths li miixx neċesserrjament normali.’ (Participant 4)

‘When children aren’t affected this shows that this is coming because of their resilience because children have some inner strengths which aren’t necessarily normal.’ (Participant 4)

Data here determines that supporting a child to develop strong coping mechanisms to deal with the effects of the abuse does not rely only on the institution but also on the child’s personality. This means that a child resistant to support may change the way he looks at his future. However, children with strong coping mechanisms are likely to keep moving on in their life events with positive determination which contributes towards success.

On the other hand, an interesting finding that emerged was that not all children who would have experienced abuse are influenced in their education.

‘Għandna A student li avolja ghaddiet minn ħafna affarijiet, hija l-aktar waħda brava, iġġib marki tajbin, tħobb ħafna l-iskola, u l-hobbies tagħha huma li taqra u tistudja.’ (Participant 6)

‘We have an A student who despite having gone through a lot she is one of the brightest where she obtains good grades, enjoys school and her hobbies are reading and studying.’ (Participant 6)

However, from the data it emerged that the number of these cases are at a minimum; this clearly indicated that, as a professional, one has to assess every case individually in order to understand whether the individual is affected or not and what support is required in each case.

**Children’s Attitude**

While some children may be affected in their ability to perform well in the main subjects, participants claimed that this may be the result of lack of concentration or low ability as this influences the child’s ability to cope with his education.

‘Għandna ħafna tfal fejn il-Maths huwa ta’ problema għax it-tfal ma jkunux jistgħu jikkonċentraw fuq li jikkalkulaw u equations u graphs. ċertu tfal ikollhom diffikultà li jikkonċentraw allura ma jkollhomx dik il-paċenzja ghal dawn l-affarijiet.

‘We have many children where Maths is a problem for them because they cannot concentrate on calculations, doing equations and graphs. Some children have a difficulty to concentrate; therefore they wouldn’t have the patience to do these things.'
Also as a consequence of the abuse and neglect, we encounter several developmental delays in these children which can be ... I hate to say it ... but it is inherited where their parents have a low IQ level and the children inherit it. Thus there is a pattern where it runs within the family.’ (Participant 8)

Since data here proposes that there are different causes why a child’s education is negatively impacted, a professional person should clearly examine a child’s case holistically prior to making interventions as he cannot perceive these children as being educational failures.

However, researchers have argued that dealing with the effects of abuse depends on the child’s coping mechanisms which may be influenced through having a strong personality, a good sense of humour and a strong intellect/active imagination (Jaffee et al. 2004: 44–55). Others have argued that developing strong coping mechanisms depends on the individual’s environment (Collishaw et al. 2007: 211).


‘Coping strategies sometimes go from one extreme to the other. We have children who do not want to know anything that is school-related with a result that they find it difficult to concentrate on everything which has to do with school. I had children tell me that: when I came to think and the teacher expected us to remain focus, my brain immediately started thinking on bad things and experiences. Then there are children who manage to cope because they become obsessed with focussing on their studies.’ (Participant 3)

In this regard, it is seen that supporting a child to develop strong coping mechanisms to deal with the effects of abuse does not rely only on the institution but also on the child’s personality. This means that a child resistant to support may change the way he looks at his future. However, those with strong coping mechanisms are likely to keep moving on in their life events with positive determination which contribute towards success.

Research also claims that different parenting styles have been exposed to influence children’s perspective towards succeeding in education (Bonnici, 2014).
Therefore, it is argued that while a child’s priorities may be influenced as a result of abuse, one’s family culture also exerts a great influence on his prospects towards education. This is because if the child had never been encouraged to attend school while he was exposed to abuse, his priority would be to overcome the traumatic event. As this may take the child a long period of time, one would fall behind in his education till a point that coping with education becomes nearly impossible due to the loss of knowledge.

Apart from the children’s family culture, it is common that the effects of abuse on the children's well-being are also reflected on one's own attitude where it was a commonly found that children may show some resistance when placed in out-of-home care after undergoing abuse (Abdulaziz 2013: 55). Such an attitude may be a result of a lack of understanding of why they were placed in out-of-home care which may accumulate towards exhibiting problematic behaviour as a way of gaining attention (ibid).

Data here seems to propose that while children who have experienced abuse are affected in various ways, the attitude that they may be exhibited in out-of-home care may be a result of that their priority would still be to continue living within their primary family. This makes it evident that, while it is important for care institutions to understand the underlying reasons of such an attitude, they should focus on dealing with the effects of the children’s behaviour in order to help them cope with their situation.

Additionally, the effects on one’s own behaviour as a result of abuse may range from chronic low self-esteem to severe dissociative states (Child Welfare Information Gateway 2013).
‘As abuse affects how a child portrays his self-image, it would eventually affect his ability to interact with other children and their ability to concentrate on a task. As a result, these children try to keep their situation a secret owing to the fear of being labelled.’ (Participant 1)

In this regard, data seems to indicate that the experience of abuse may negatively affect the individual’s control of his life. However, it is claimed that a holistic support system is always needed to help the child cope with his life events.

**Supporting Children’s Education**

It is important that children’s homes support children in care holistically in their education. This is due to the fact that research claims that, while the education concept is a strong pillar in a child’s life (Government of UK 2017), it has been proven that promoting the school culture within the home helps the child to adapt within the school curriculum system better as he would feel that there is a holistic support between home and school (Emond 2012: 194–202).

‘Once you start creating an educational culture within the home, going to school becomes so obvious that children wouldn’t think to tell you no.’ (Participant 3)

Data suggests that care homes need to have a strong supporting educational system incorporated within the culture system which motivates and helps the child to remain focused on his education.

Moreover, it was argued that when developing a supportive system, one should base it on feedback which is needed to develop an efficient care plan and to maintain it. Literature claims that, without feedback, the care system would be rigid as there would not be an individualized service (Carnegie 2015). During the whole process of feedback, a Personal Educational Plan is developed to ensure that the child’s needs are constantly being addressed individually (ibid.). This will eventually lead to developing an efficient in-house educational plan which will help supporting a child in care better throughout his education.

‘Part of our assessment is to interact with schools and see how last year/this year the child is doing in terms of educational level, how he is doing, if he has an LSA or not, what were the difficulties and strengths, if there is IEP?, etc. Here we get a clear picture of the educational level the child is currently in.’ (Participant 2)

Data in the present study indicates that, while conducting an assessment should be the priority to support the child holistically, it is essential to get feedback from the individuals who are involved in the child’s case. This means that while facts would
be gathered, an efficient in-house educational programme would be developed to address the child’s educational needs holistically.

**Management Support**

Research has shown that the management’s contribution is vital in care homes in helping children who have experienced abuse to overcome their traumatic experiences (Underwood 2016: 76). Research has proven that providing a friendly family environment rather than an institutional environment through supporting employees helps children to stabilize their life again (ibid). This system is reflected in one of the participants’ argument where:

'Bħala management ahna nvoluti ħafna fid-daily life tat-tfal. Hemm integrità bejnietna ghax m’hemmx qasma bejn dak li qed nagħmlu ahna il-management u l-istaff ghax ahna l-istess nies. Ahna nemmnu li management irid ikun involut ħafna fil-hajja tat-tfal. Infatti ahna mis-1.30/2.00 p.m. l’hemm kulhadd jitlaq mill-uffiċju u kemm jista’ jkun ikun qed jipparteċipa fil-hajja tat-tfal b’xi mod jew ieħor’ (Participant 3)

‘As management we are involved in the daily life of these children. Among us there is integrity because there isn’t a division between what we do as a management and as staff as we are the same people. We believe that the management has to be involved in the life of these children. In fact from 1.30/2.00 p.m. forward, we leave the office in order to ensure that we are participating as much as possible in life of these children in some way or another.’ (Participant 3)

It is proposed that the management should be involved on a practical level since this is beneficiary towards understanding front liners. Data seems to indicate that this helps in understanding the struggles that employees deal with on a daily basis, thus being capable of developing adequate policies and providing practical materials which better assist and direct the work of these professionals. Eventually, this leads to enhancing confidence in the staff to give their utmost to support these children.

**Limitations**

This study faced several limitations. One was that, during data collection, socially desirability bias may have been encountered because interviewees may have responded to a question in a way that they thought the question should be answered, rather than giving a true answer.

Another limitation was that, since this study was qualitative in nature and interviews were held with just eight participants, one cannot draw general conclusions. Creswell (2009:190) claims that to have more accurate results, a researcher should carry out between twenty and thirty interviews. However, due to time constraints, interviewing more participants was not possible. Nevertheless, since participants came from different agencies that support children of different ages, this gave quite a wide picture of the local children’s out-of-home care sector.

**Conclusion**

This paper has proven that, despite the fact that abuse is a negative event that no one should pass through as it goes against the value of humanity (Coalson 2013), society should never look at children in care as being educational failures. Indeed professionals working with children in out-of-home care should enhance a supportive
attitude in their practice to help the child rebuild the trust that abuse would have destroyed, thus helping him to develop the skills needed to face the future without fear.

This research made it evident that several study areas can be explored in the future. In fact, longitudinal studies could determine what happens to children who have experienced abuse after completing their compulsory education. Such a study can be conducted through semi-structured interviews held at different intervals with the researcher using the children’s attitudes, beliefs, feelings, reactions and experiences to understand the struggles they face when leaving care after finishing compulsory education. This will be vital towards proposing new strategies to better support children in care to proceed to tertiary education.

Future research could also look into why some children admitted in care do not proceed to tertiary education. Several causes may be explored such as how their past experiences might have impacted their present thinking when it comes to proceeding to tertiary education. This study may further explore the existent supportive measures that assist these children during their tertiary education and what improvements can be done. This study may help develop the basis of a system which supports the child to remain on course to reach tertiary education.

Research could also examine whether different children’s residential homes influence differently the child’s ability to succeed. This research could be carried out through case-study research which evaluates the services that support these children. This proposed study should evaluate better which educational methods help children in care to succeed educationally.

Other improvements could be the development of a policy to support the education of children admitted in care. Since currently we do not have a direct policy which has been developed to cater for the educational needs of children in care, developing such a policy to assist professionals involved in the child’s life in their day-to-day practice is vital as this would lead towards having an ethical performance.

Another policy which may be developed is to examine how care professionals work with external professionals involved in the child’s case. Since currently there is no established policy on how care professionals should work with external professionals, this policy should facilitate coordination between professionals so that the child will develop the sense of security as professionals will intervene in the right time to motivate the child to face life events.

Finally, improvements are also needed within the service provision. In fact, it is recommended that every child is provided with an educational psychological assessment upon admission in care, which is vital to understanding better the impact that abuse would have left on the child in terms of his educational level. It is essential that this assessment should be funded by the government as children’s homes are struggling to provide every child with an educational psychological assessment owing to financial burdens.

Also since today children’s homes are providing numerical and literacy lessons to help these children in their education, the government should support residential homes in assisting them by providing free private numerical and literacy lessons; thus, investing in the education of these children.
References


Malta’s Higher Education Dimension: Analysing the Extent of Complexity in Change

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Abstract: Change is a constant challenge in the higher education sector. Higher education institutions (HEIs) are expected to respond adequately to developing circumstances. This paper focuses on the extent of complexity in change, a factor that at times is overlooked. It brings into light the reality that managerial changes, that were affected to respond to the changing context, could eventually result as an inhibitor towards achieving the desired performance. The first section of this paper outlines the determining changes shaping the Maltese higher education context through a comparative global perspective. Section 2 assesses how contextual changes are influencing the governing and managerial dynamics of higher education. This section also introduces the notion of Key Performance Indicators (KPIs). Section 3 discusses the extent of complexity stemming from institutional structures and through the State-institutional relationship. Section 4 reviews the extent of complexity in a continuum of structures and managerial processes by considering programmes of study, staff, stakeholder involvement, collaborative arrangements, and funding.

Keywords: Higher education; change; complexity; governance; managerialism; performance.

Research Methodology

The research methods employed in this paper are mainly two: the first method involves the analysis of documents and data published in international and local academic journals. Statistics published by the National Commission for Further and Higher Education (NCFHE) and the National Statistics Office (NSO) were the main source of local statistics. The second research method involves national and institutional data that was specifically requested for this study and that has never been published before. The University of Malta (UM) and the Malta College of Arts, Science, and Technology (MCAST) were asked to provide data to substantiate the arguments that are presented regarding the Maltese higher education context. In all instances headcount data is used.
This mixed methodology approach was selected in order to capture the complexity of the subject and to provide a comprehensive outlook to the subject matter. Furthermore, unpublished data that is either provided by institutions strengthens the credibility of the information presented and of the analysis provided throughout this paper. The exact figures that pertain to staff, programmes, and funding provide the possibility for a thorough analysis, especially with regard to the comparative review between the UM and MCAST. The previously unpublished data also provided the possibility for an analysis of data over a period of time in order to understand better the developing context in Malta’s higher education. Trend analysis puts also a spotlight on possible future developments.

Introduction: Contextual Change and its Influence on Higher Education Governance and Management

Organization change is as old as the organizations themselves (Burke 2011: 29). Organizations have to rejuvenate themselves if they are to respond effectively to the external environment that is putting so much emphasis on performing organizations. HEIs have changed in two main ways: first by embracing a more scientific, evidence-based approach in order to guide their actions. This essentially meant that HEIs started to embrace a performance-oriented approach by setting targets and gathering data. This paper examines this stance by presenting examples of how has the context contributed towards performance management.

The second major change necessitated that HEIs are being faced with an ever-increasing diversity of external forces. In this continuous changing environment, HEIs are responsible to design courses and embark on research initiatives that reflect the exigencies of the labour market and the dynamics of the modern economy.

The two major causes for change – massification and globalization – have put HEIs on a national economic, political, and social platform. Massification means that, as Austin and Jones (2016) assert, universities educate professionals in a long list of academic fields; from engineering to health science, medicine and surgery to education, commerce to sciences and information technology to new academic disciplines such as digital media. The challenge of massification resulted in a large segment of the population moving up the ladder of social mobility. The direct result has been that the demand for higher education has increased significantly in the last few decades.

Massification within a context of globalization, continuous change, and fierce competition necessitated that one of the main objectives of the EU is to have 40% of all young people achieving higher education or equivalent standards since 35% of all jobs require such a level by 2020 (European Commission 2018). Consistent with this trend, one of the major priorities for the Maltese islands was to attract 85% of students leaving school into post-secondary education by 2015 (from 59% in 2009) and attract 35% of school-leavers into higher education by 2020 (from 23% in 2009) (NCHE 2009: 36).

The Higher Education Strategy for Malta published in 2014 focused not only on the general objective of massification but, as happened in the foreign context, on specific measures such as increasing the participation of unrepresented groups in
higher education. The report cited countries such as Finland, Ireland, Switzerland, and the Netherlands who are getting increasingly closer to achieve an inclusive system. The projection for Malta’s higher education population is that the extent of these unrepresented groups will diminish and with it brings a further increase in the students’ population (NCHFE & MEDE 2014). This will inevitably put a lot more pressure on the infrastructure of Malta’s HEIs, an aspect which was stressed in a number of reports and papers, such as those published by von Brockdorff (2010) and Camilleri (2010).

The second and other main cause of dramatic change in HEIs is globalization. This reality was brought about and largely shaped by the integrated world economy into a boundary-less territory and the deployment of effective IT systems which made it much easier for students to apply at other foreign universities, move from one university to another and increasingly undertake on-line courses which can be followed by the students at their own pace. For HEIs, such a globalization process has entailed inter-institutional partnerships in numerous different forms such as exchange programmes and the setting up of branch campuses overseas (OECD 2009: iv).

This paper analyses the drivers for change and its influence on governing structures, management, and performance. It shows that universities do not operate in a vacuum and have to react to changing student demographics, the change in students’ expectations, the indirect and direct competition which exists in today’s highly vibrant higher education sector and the ever-increasing problem of limited resources and greater government scrutiny which were highlighted by Scott (2008) when summarizing the changes ahead for all universities.

Governance, management, and performance were outlined in the report entitled ‘Governance and Quality Guidelines in Higher Education’ published by the OECD (2009: 18). Important overarching changes were proposed and include, first, the diversification of provision, especially from private educational organizations which has increased dramatically over the years, not least in Malta; second, new modes of delivery including online delivery of material to students; third, a more heterogeneous higher education population which is essentially based on the fact that enrolled female students increased substantially over the years; and fourth, the greater focus on research and innovation which shifted the modus operandi of higher education institutions from purely predominantly teaching mode to a more project- and innovation-oriented mode.

Other overarching performance targets were highlighted by Leach (2008) who listed a number of factors as a direct result of a rapidly changing environment and that gave more importance to the governance and managerialism in HEIs. The factors include the view that higher education is to synchronize better with the exigencies of the labour market, the increasing citizens’ expectations for accountability, the pressure to increase student retention and graduation rates, the focus on non-traditional students by investing in liberal arts and science programmes and the investment in more in online learning courses.

More specific performance indicators that are intimately related with change and reforms were specified through the Modernisation Agenda document entitled ‘Supporting Growth and Jobs: an Agenda for the Modernization of Europe’s Higher Education Systems’ published by the European Commission in 2011. The document outlined the reforms which are crucial for a successful future of higher education, such as increasing the number of higher education graduates at all levels, strengthening the quality and relevance of human capital development in today’s economy, effective
governance and funding mechanisms, strengthening the knowledge triangle between education, research, and business and internationalization of higher education (European Commission 2011: 6).

Change and external pressures also presented a challenge of finding alternative ways of funding the operational and capital budgets, the expectations of citizens for a higher value in the delivery of higher education programmes, the creed for providing a better service to the students, and the reality of relying less on public funding. The report ‘2020 Vision or Optical Illusion?’ written by former University Rector Juanito Camilleri, back in 2010, stressed the problem of funding and agreed with von Brockdorff (2010) that the university needs to find flexible and innovative ways of financing its activities in order to cope with the pace of change and the challenge of massification. Camilleri (2010) proposed the exploration of a market-driven approach and new lines of funding in order for the university to be able to invest more in research; in campuses spread in Gozo, Valletta, and Cottonera; in collaborative programmes; and in its IT systems, including the Student Information Management System (SIMS) which helped tremendously to capture all administrative services into an online portal.

Literature reviewed so far focused on providing answers to the changing and highly competitive environment by exploring different avenues of funding. Governance and effective management comes into play as another important factor for a higher education institution to respond to students’ expectations and to achieve its objectives (Austin & Jones 2016) by looking into its managerial and governing engine and assess its operation.

The Effect of a Changing Scenario on Governance, Management, and Performance

Globalization has led to the massification of HEIs and delineated the changing parameters of higher education. However, the question that is of interest to this paper is: how did the changing higher education scenario influence the management and governance of Malta’s public higher education? The aim of this section of this paper is to begin dissecting the link between change, management, governance, and the idea of setting performance indicators.

Changes were so profound (Guri-Rosenblit 2007) that, in the second half of the twentieth century, terms such as ‘higher education’ and ‘higher education systems’ were being coined. More recent literature shows that HEIs are not immune to the changing global scenario especially following the international financial crisis in 2008. Scott (2015) describes the changing scenario as prompting the strengthening of institutional autonomy, managerialism, the elaboration of management structures, and the focus on a cost-sharing approach by charging higher student fees.

Tougher competition from the private sector and from the international arena, compounded with a broader clientele, has led to dramatic changes in the way HEIs are governed and managed. A number of governing and managerial outcomes can be observed as a direct or indirect consequence of the contextual changes. New structures were established, existing structures were re-designed, new managerial processes were instituted, and stronger quality assurance mechanisms were introduced. HEIs also embarked on outreach programmes whilst engaging more in collaborative arrangements. This meant that public HEIs built an extensive number of relationships with civil society, the research community, and the private business sector. The panorama of governing and managerial changes led HEIs to an increase in the number of academic and administrative staff.
The link between change and managerialism is not only found in academic literature. International reports confirm such a pattern. All reports published by UNESCO, the European University Association (EUA), and by HEIs themselves point out governing and managerial issues, in addition to providing a contextual analysis. In 2015 a Trends seventh edition survey, published by EUA, was conducted in which 451 HEIs participated from 46 countries. It can be considered as a massive survey since it represents a global total of 10 million students and a quarter of students who are enrolled in HEIs forming part of the European Higher Education Area (Sursock 2015). Malta participated in this study through the UM. The Trends survey focused on teaching and learning aspects that are outside the scope of the thesis. However, the report demonstrated that teaching and learning are intimately influenced by management, governance, structures, and decision-making powers. Therefore, governance and management are infiltrating all aspects of institutional operations; it is no longer possible to hold the idea that teaching, learning, and research are a separate domain from governance and management.

Setting the context and studying governance and management in isolation would yield a limited and a half-baked approach, as if these two dimensions operate in a vacuum. On the contrary, effective governance and management must lead to results. Although scholarly literature confirms that effective governance and management undeniably influence the performance of HEIs in a continuum of aspects, international rankings base their rankings methodology on various aspects of higher education but not directly on governance and managerial issues. International rankings are used by HEIs to build and maintain their reputation among students, researchers, and crucial stakeholders that seek factual information concerning scholarships, funding, accreditation, and employee recruitment. Shanghai Academic Ranking of World Universities and Times Higher Education University Rankings are two of the most influential and widely observed university rankings. Shanghai rankings focus on the quality of education (10%), quality of faculty (40%), research output (40%), and per capita performance (10%) (Academic Ranking of World Universities 2015). The Times Higher Education Rankings estimate a weighting of 30% for teaching, 30% for research, 32.5% for citations, 2.5% for industry income, and 5% for international outlook (Times Higher Education, World Rankings 2016).

The University of Malta takes part in the U-Multirank, a ranking methodology that was introduced in 2014 and is fundamentally different from the remaining ranking institutions. U-Multirank is based on a multi-dimensional, user-driven, and stakeholder-ranking approach rather than producing what they call ‘an oversimplified global ranking league table’ that could be misleading to those students or stakeholders that seek information. In simple terms, users have to opportunity to compare universities, subject areas, and specific institutional standings such as research (U-Multirank 2017).

Whatever the methodology used in international rankings, a specific tool to analyse various aspects of governance and management is absent. This does not mean that facets of governance of management are excluded or that there is no interplay of these two dimensions with the results of international rankings. What is lacking is the focus on structures, transparency, accountability, leadership, management processes, participation of students, staff, and stakeholder involvement that lead to better results in the selected indicators.

Key performance indicators (KPIs) are instruments that were developed in the New Public Management era, intended to assess organizational activities from a procedural and performance-based perspective. KPIs were originally introduced in the private
sector as a tool to assist firms to manage their resources better, to achieve the intended outcomes, and to ensure that an organization is consistent with its own strategy gained significance (Mackie 2008). As from the 1980s, KPIs spread to the public sector in the Scandinavian countries and in the United Kingdom and became a standard tool in almost all EU countries as from 2002 to 2015 (Bezzina, Borg, & Cassar 2017).

In the higher education literature there is limited focus on the inter-relationship between governance, management, and performance indicators. These three facets are most often studied in isolation and not as a comprehensive framework that involves a strong relationship and that could lead to improved results, if each is given due importance. In most instances literature confuses governance with management and fails to differentiate the two different but strongly bonded concepts. In other cases where there is a study of the relationship between governance and management, there is lack of focus on their ultimate influence on performance.

In Malta, KPIs is a relatively new concept that has been in operation in the public service as from 2015. A comprehensive KPIs framework is still in the embryonic stage. In the higher education sector, the same situation is present since the use of KPIs is either totally absent or is in its infancy and sporadic. The idea of creating a culture of excellence and injecting a KPIs approach was fuelled by the signing of the new collective agreement for the public service employees in 2017. The prime minister highlighted the issue in a political forum, at the annual general meeting of the Labour Party that was held in April 2017, by stating that the increase in salaries and the improvement in the working conditions of the public service employees are tied with the introduction of KPIs and achieving the set targets. It remains to be seen whether the implementation of KPIs in the Maltese public service will eventually spread to other public institutions, including HEIs.

The following sub-sections analyse the influence of contextual changes on Malta’s higher education governance and management and attempts to examine what would be the ultimate influence on KPIs, if set of performance indicators were to be introduced in Malta.

Making Sense of a Wide-Spectrum Student Clientele: Assessing Change Vis-À-Vis Structural Complexities and Performance Indicators

If HEIs are to successfully introduce and implement a performance-oriented culture, they are to encounter the difficulties stemming from the complexities of their own structures and the intricacy of their relationship with the State. The advent of massification resulted in two major structural challenges: the expansion of the HEIs portfolios and the changing nature of the State-institutional relationship.

Organisational and governing structures had to fit within the changing circumstances of a globalized competitive world and an extensive student clientele. Institutional structures became bigger and, as Sursock (2015) emphasized, they turned into laborious organizational charts. HEIs became much more complex to manage and to monitor in an effective manner given the number of units or departments in operation.

The argument that HEIs are not anymore simple organizations owing to contextual changes was also postulated by Stromquist (2012). The direct effect of multiple structures led to the creation of multiple offices in several administrative areas such as admissions, international office, quality assurance, strategy, and corporate offices.
The UM is a case in point since it consists of more than 220 units or departments. HEIs:

... may require reviewing the number and size of units (faculties, departments, institutes) to ensure, for example, that they facilitate interdisciplinarity, as well as the balance between centralised management and more devolved responsibilities in order to ensure shared institutional quality frameworks and standards while enabling diversity and innovation across the institution (Sursock 2015: 15).

If HEIs do not have a co-ordinated framework of structures that could retain their diversity of actions (Austin & Jones 2016: 1) and a parallel sense of a collective achievement, their ability to become a performance-oriented institution will be seriously limited. Structure is only one variable of the entire complex equation since other issues, such as in the increase in staff and collaborative arrangements, add to the challenge of having effective and efficient decision-making processes (Kezar & Eckel 2004) that are performance-oriented.

In Malta, the reliance on a limited number of public HEIs, as opposed to the international experience that saw the rise of a number of heterogeneous HEIs to cater for the massive increase in the demand and to absorb a large number of students (Guri-Rosenblit 2007), puts more pressure on expanding and creating more structures within the public institutions. Having a large number of structures within an institution could prove challenging in terms of coordination and collective effort.

From a national perspective, HEI governing models around the globe responded to the complex contextual reality by shifting from a ‘State control model’, that is intended to control HEIs, to a ‘State supervisory model’ where the State’s function is to monitor and supervise HEIs rather than having a direct and controlling involvement. In the 1980s (Zgaga 2012) radical changes in the State-institutional relationship meant that the State’s role was not any more focused on ‘direct institutional governance’ but is rather that of a ‘facilitator’ by setting general objectives and strategic direction, most often through the a regulatory umbrella. The facilitating role led to what Kenis (2016) described as collaborative governance.

Nevertheless, the role of the State and the relationship between the central State authorities and HEIs are of crucial importance in successfully administering KPIs. This has been confirmed through a survey conducted by Bezzina, Borg, and Cassar (2017) with all EUPAN public administrations, where a total of 27 countries responded and highlighted the importance of a functioning State-institutional relationship when it comes to manage KPIs within a complex and large public administrative framework.

Malta’s State’s governing model lies between a ‘direct institutional governance’ or ‘State control’ model and a ‘supervisory’ or a ‘facilitator’ model. On one hand, there is direct control and strong leverage from the government from a resources and policy point of view when considering that a large percentage of the HEIs' budget is derived from the central government and when taking into account that the national higher education policy is the sole responsibility of the central government. On the other hand, the national governing framework has been shifting towards arms-length regulation since the introduction of the National Commission for Further and Higher Education (NCHFE). The commission, officially launched on 14 September 2012, is governed by the revised Education Act which came into force on 1 August 2012. The previous MQC has been integrated into the National Commission for Further and Higher Education (NCFHE) and is now referred to as the Malta Qualifications Recognition Information Centre (MQRIC) (http://www.eurashe.eu/about/partners/ncfhe/).
The question worth investigating is: Are today’s HEIs really more autonomous and free to govern and manage? If HEIs are not really autonomous, their ability to achieve the intended performance indicators will be seriously limited. In theory, the shift from ‘government’ to ‘governance’ was supposed to bring about greater institutional autonomy and stronger decentralization. Autonomy has to be analysed within the contextual circumstances of the country in question. To cite some examples, in Denmark more autonomy meant less State power, in US more freedom of speech, in the UK more freedom in staff appointments and student selection and more flexibility in the teaching and research agenda (Wright and Williams Orberg 2009).

In reality, the context of globalization and massification led nation states to exercise tighter control on HEIs in order to achieve the national economic objectives. HEIs are today seen as a means towards an end to achieve the national economic targets of the state. At an international level, rankings (even though these instruments are heavily criticized) are dictating the policy and strategic direction of HEIs (OECD 2009). From a societal perspective, the rising expectations of the citizens meant that the government is more involved in order to ensure that the citizens get value for money spent on public HEIs (Austin & Jones 2016). These reasons show the active involvement of governments in the business of HEIs and signify the tendency towards stronger centralization rather than more decentralization.

The EUA studied the state of university autonomy in 2016 by analysing four dimensions: organizational autonomy, financial autonomy, staffing autonomy, and academic autonomy (Pruvot and Estermann 2017). As a start, this section analyses briefly the organizational and financial autonomy in Malta.

From a financial perspective, Table 1 shows the substantial reliance of the UM’s budget on government funding. In fact, the average proportion of the total university budget derived from the central government is approximately 70%. MCAST’s reliance on central government financial injection is higher and is at levels of between 96% and 97% when considering the period 2013 until 2016.

Table 1. The reliance of the UM and MCAST budget on the government’s financial allocation. Author: Colin Borg (2018) – Data extracted from UM Financial Audits and MCAST Annual Reports 2014/15 & 2016/17

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central Government Funds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UM</td>
<td>53,462,326 (70.9%)</td>
<td>58,027,333 (72.1%)</td>
<td>62,069,493 (73%)</td>
<td>68,889,666 (73.9%)</td>
</tr>
<tr>
<td>MCAST</td>
<td>18,199,999 (97.3%)</td>
<td>19,799,989 (96.5%)</td>
<td>21,679,985 (95.9%)</td>
<td>23,299,983 (96.6%)</td>
</tr>
<tr>
<td></td>
<td>Total Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UM</td>
<td>75,420,352</td>
<td>80,476,240</td>
<td>84,993,287</td>
<td>93,191,865</td>
</tr>
<tr>
<td>MCAST</td>
<td>18,705,847</td>
<td>20,510,738</td>
<td>22,609,847</td>
<td>24,117,160</td>
</tr>
</tbody>
</table>
From an organizational point of view, although the rector and the executive head are chosen by the university’s council, there is considerable lobbying from the central government and, most importantly, the government has the majority of UM’s council seats. Furthermore, policies and legislation are determined by the ministry responsible for education following consultations with HEIs. The crucial point is that the ministry is the initiator and HEIs have a limited influence on the strategic direction of higher education. The National Higher Education strategy of 2014, the revamp of the existing 1988 Education Act, and the draft new University Act of 2017 are cases of initiatives that were or are being handled almost completely by the central government.

The Education Act that will be completely repealed and replaced by a new University Act is an example of a mixed dose of centralization and decentralization. On one hand, from a policy-making perspective, the new act is being completely written by the ministry responsible for education and therefore involves a strong element of centralization. On the other hand, from a structural and implementation point-of-view it delineates more decentralization and hence a shift towards a ‘supervisory model’ when considering that the planned new Education Act is intended to provide more independence and autonomy to the university. The notion of independence and autonomy is being heavily questioned owing to a continuum of instances that shows central government intrusion in institutional affairs (Zgaga 2012).

Taking into account these real-life examples, it is appropriate to present a diagram that incorporates three different models of State-institutional relationships. In the real world, there is neither an absolute direct interventionist model nor a utopian supervisory model. HEIs do not use a model and discard the other in all circumstances. The relationship between the State and HEIs alters in accordance to the circumstance at hand. Figure 1 portrays three different possible relationships varying from a complete institutional autonomy to a more joint involvement and to a high degree of institutional dependence on the state. In all types of relationships there is always a certain level of autonomy, involvement, and dependence.

![Figure 1. Types of state-institutional relationship in higher education (Colin Borg, 2018)](image)

Malta’s State-institutional model reflects these three types of relationships. In instances when HEIs create a new programme there is a high degree of institutional autonomy, although in certain instances the central government is actively involved in influencing institutions to invest in particular academic domains. Investment in the banknote printing facility by Crane and the health sector by Barts were the drivers behind the influence of the central government on MCAST to invest in specialized courses. This example shows that although the general circumstances allow HEIs to design and deliver new courses autonomously, there are economic and societal situations that change the institutional leverage to that of involvement rather than autonomy.
Such a dynamic, elastic, or even volatile relationship can be noticed in other governing and managerial illustrations. The determination of course fees is a case a point. While fees are autonomously determined by the institutions, fees have to be promulgated through a legal notice that requires the minister’s approval. This shows that, at the end of this important financial process, the degree of institutional autonomy is reduced dramatically.

In other instances there is a more definite and stable type of State-institutional relationship. The drafting of national strategies reflects a permanent institutional involvement style when considering that the central government is mainly responsible to write the higher education strategy while UM and MCAST are only involved as the two main Maltese HEIs. The financing of Malta’s HEIs represent institutional dependency given that 70% of the budget is financed by the government. Institutional dependency is more evident when they require an increase in the annual budgetary allocation. In such cases, HEIs have to present a detailed and comprehensive rationale to ministers in order to be allocated an increase in the financial budget.

Dependence on the government from a resources and a strategic perspective limits the capability of HEIs to achieve the intended performance indicators, especially if these require some form of input from the government.

The Influence of Change on Managerial Processes and Performance Management

The influence of contextual changes and the multiplication or the widening of the existing structures have led to dynamic developments from a managerial point of view. Change in managerial processes can be regarded as having different facets. On one hand, change entailed stronger management in terms of effectiveness, harmonization, simplification, stronger accountability, and adherence to regulations, on the other hand, it added to more managerial complexity in terms of processes, staff, and collaborative arrangements. Contextual change added more value to HEIs considering the wider portfolio of academic programmes on offer and the research initiatives that they have been involved in but this means more complexity when and if Malta decides to introduce a formal set of Higher Education performance indicators at a national and at an institutional level.

Complexity through Globalized Higher Education Managerial Processes

Globalization, through the Bologna Process (Altbach 2016), is an example of the opposite facets of higher education contextual change. It brought about a better governing tool by encouraging student mobility, ensuring more accountability, and adherence to regulations by having uniform programmes of studies. Uniformity compounded with clarity of the course structures meant that courses became more marketable to the intended students’ groups irrespective of nationality. Students now have the possibility to view the programmes details well in advance and could seek redress in cases where the course programmes are not consistent with the Bologna requirements. The UM’s and MCAST’s central administration capitalized on this important academic development since the concept of indicators, although not officially launched, is already being used.

At UM, the teaching academic effort and financial managerial processes such as activity-based costing could be conducted on the strength of the information provided in the programme of study. This meant that the university gradually became more performance-oriented and decisions are taken on the basis of evidence-based
information. These new managerial processes could prove to be the foundation to a future performance mechanism.

Nevertheless, what were the structural and managerial consequences of these steps? New administrative structures and filters were created to facilitate these new processes through the set-up of an administrative unit, the Academic Programmes Quality and Resources Unit (APQRU) and the senate sub-committee, the Programme Validation Committee (PVC). At MCAST two separate directorates were set-up to focus on curriculum and quality assurance. This entailed that programmes are now better planned and more informative but faculties or institutes are experiencing more complexities and more administrative filters as part of the due diligence procedure to publish a programme of study.

The set-up of these new structures and the direction of the university to cater for the exigencies of the labour market and the demands of potential students led to a significant increase in the programmes of study on offer. This development fuelled the complexity of managing an increase of 40% in the programmes between 2002 and 2017. The total number of different programmes of study and routes offered by UM are more than 800. Details of the increase in the number of programmes during this period are provided in Table 3. Although the increase in the delivered programmes could be perceived as a positive performance indicator, it brings about more work and challenges in terms of quality assurance, timetabling, IT technologies, library resources, and, most importantly, administrative and academic staff. The university has to ensure that there are sufficient resources to run the programmes and to check that there is no overlap within an impressive amount of more than 5,000 study-units that are offered each academic year. The administrative structure of the university is to dedicate the necessary vigour in order to update the information concerning the study-units in terms of content, lecturing staff, and methods of assessment in a timely manner before the commencement of the respective academic year.

The set-up of MCAST’s University College in 2015 was crucial to cater for a total of 1,600 active full-time students. Statistics show a substantial increase, as was the case with UM, from nil programmes at Level 5 upwards in 2002 to 45 programmes in academic year 2016/17. MCAST figures reflect the full-time programmes only. The change process did not only necessitate an increase full-time programmes but also in MCAST’s teaching and learning approach through the introduction of cross-curricular programmes, work-based learning and skilling in business enterprise. Considering the 10% increase in student population in the second year of the university college, new undergraduate degrees were launched in journalism, environmental health, nursing studies, early childhood and education, environmental engineering, and chemical technology (MCAST 2018).
Table 3. The increase in the UM and MCAST programmes on offer at Level 5 upwards. Author: Colin Borg (2018) – Data provided by the University of Malta, SIMS Office and MCAST’s Students Admission and Records Office

<table>
<thead>
<tr>
<th>Number of Programmes</th>
<th>Academic Year 2002/3</th>
<th>Academic Year 2007/8</th>
<th>Academic Year 2012/13</th>
<th>Academic Year 2016/17</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM – full-time and part-time</td>
<td>100</td>
<td>112</td>
<td>157</td>
<td>210</td>
</tr>
<tr>
<td>MCAST – full-time only</td>
<td>nil</td>
<td>20</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

**Complexity through Staff**

Data collected from UM for the period 2002 until 2017, as revealed in Table 4, shows the increase in the number of staff in all categories: resident full-time academics, visiting council-appointed part-time lecturers, and casual *ad hoc* staff appointed on an hourly basis. Data in the below-mentioned table also shows a significant increase in the managerial, administrative, and technical staff.

Table 4. The Increase in the UM’s Staff. Author: Colin Borg (2017) – Data provided by the University of Malta, Office for Human Resources Management & Development

<table>
<thead>
<tr>
<th>Staff Category/Year</th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Academics</td>
<td>194</td>
<td>381</td>
<td>830</td>
<td>955</td>
</tr>
<tr>
<td>Visiting Lecturers</td>
<td>58</td>
<td>94</td>
<td>656</td>
<td>794</td>
</tr>
<tr>
<td>Casual Lecturers</td>
<td>No Data</td>
<td>No Data</td>
<td>1205</td>
<td>1213</td>
</tr>
<tr>
<td>Admin &amp; Technical Staff</td>
<td>No Data</td>
<td>No Data</td>
<td>702</td>
<td>957</td>
</tr>
</tbody>
</table>

The number of MCAST staff is also significant when considering that in 2018 the College employs 739 staff, which number includes the administrative and academic cohorts. This global number comprises the staff of the three main colleges: the foundation, technical, and the University College. When comparing with the year 2017, the percentage increase in the number of staff has been of 5%. The number of staff at the University College is much more limited in number, just 17, since it is still in its inception and all staff are until now employed on a full-time basis. This number is expected to be on the increase in the near future given that MCAST’s vision is to increase substantially the number of courses at a higher education level.

The increase in the number of UM staff is complemented by the number of structures that exist within the UM. The UM consists of 14 faculties, 18 institutes, 11 centres, 2 schools, and an academy. This entails a complexity of 46 different main student
centres within its governing structure and a total of 198 departments, divisions, or units across it.

The multiplication of structures led to what Stromquist (2012) called the expansion of administrative positions. The creation of new structures and the strengthening of existing structures involve the employment of new staff or the redeployment of existing staff. The more staff is employed, the greater the challenge to work collectively, to have the necessary co-ordination, and therefore to achieve fundamental institution-wise indicators, such as increase in student numbers. There are other process-oriented indicators that could prove to be more challenging when there are a lot of structures, staff, and students involved. Speed of decision-making and participation in decision-making are two examples of process-oriented that could prove problematic with a lot of structures and staff employed within a HEI.

Complexity is not only linked to the increase in structures, staff, and students in terms of global numbers. Central-local relations within the institutions are another important critical factor to achieve the intended performance targets. Research conducted among American universities, such as the one done by Greene in 2010, revealed that complexity led to more centralization given that specialized jobs require specific knowledge and skills in order to achieve the performance indicators. This led to more concentration of power at the centre and more focus on increasing the number of employees at the central administration rather than in faculties or institutes. The undesirable result would be that the institutions could become less geared towards achieving the intended targets if the faculties do not have the necessary staff to carry out the work required from their end. The survey carried out by Rhoades during the 1977–89 period found that administrative staff at the centre increased by almost twice that of the faculty (Stromquist 2012).

In an exercise conducted with the data provided by the UM, it was discovered that 345 out of 702 administrative staff in 2012 and 535 out of 957 administrative staff in 2017 were employed within a central administrative support unit that include estates and works, library, finance, procurement, registrar’s office, human resources office, international office, IT services, research support services, and other administrative services. These figures show an increase from 49% to 56%, in the span of 5 years of staff that are employed within a central administrative structure and confirms the view that today’s specialized jobs are increasing the tendency of HEIs to employ staff at the core of HEIs, leaving faculties with fewer resources. Although central units assist faculties in their day-to-day activities, the risk of rendering faculties with serious deficiencies is real. Faculties are indeed a very important factor to achieve institutional performance indicators, given that most activities require the work and input of faculties. If, for example, one of the targets is to increase student number, the faculties’ contribution in terms of marketing and outreach is essential.

**Complexity through Stakeholder Involvement at International and Local Level**

Complexity is not only an institutional inward perspective. Complexity is multiplied by the contextual developments from a stakeholder point-of-view. As from the turn of the new millennium, HEIs became more involved in the economic, social, and environmental affairs of the State and succeeded to build stronger ties with the social and economic sectors of modern States. Furthermore, more focus on research and innovation was crucial towards strengthening the industry links, an aspect which has become increasingly important for the Maltese economy, especially following Malta’s accession to the European Union.
This outward stakeholder perspective can be corroborated to the managerial complexity by considering the required intra-collaboration of the newly set-up institutional structures to cope with the increasing number of collaborative agreements and the rising as well as cumulative amounts of funding. From a governing and a managerial perspective, the absorption of external funds and the collaborative arrangements with local and international authorities at UM and MCAST resulted in the creation of three main central new structures and in the employment of new staff. An elaborate administrative mechanism and a strong co-ordination is required to achieve a particular indicator, such as the number of national and EU-funded projects of a HEI. Complexity is not only measured in terms of new structures and staff but also vis-à-vis the intra-collaboration that is required among different central units and between central units and faculties. This kind of intra-collaboration is essential to manage the significant amount of administrative work that is involved to adhere to the EU regulations that are specific to the funded project and in order to absorb funding at a maximum rate.

The UM is a particular example of how EU accession has opened the door for enormous funding opportunities that were so significant that three new main offices were established: a Project Support Office and Knowledge Transfer Office were introduced in 2008 and a Research Support Services set up in 2016. Projects were originally managed by the UM’s finance office but the enormous increase in the amount of such projects meant that three new offices dedicated specifically to manage collaborative projects had to be created. As shown in Table 5, the number of UM’s collaborative arrangements from 2011 until 2017 increased to 1105.

Table 5. Number of collaborative involvements. Author: Colin Borg (2018) – Data provided by the University of Malta, Legal Office, and by MCAST, Partnerships Office

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Malta</td>
<td>93</td>
<td>138</td>
<td>158</td>
<td>198</td>
<td>262</td>
<td>256</td>
</tr>
<tr>
<td>MCAST</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>19</td>
<td>37</td>
<td>58</td>
</tr>
</tbody>
</table>

The tripartite model to deal with external initiatives can also be observed with MCAST which has also set up an EU Projects Office, a Capital Projects Department, and a Partnerships Office. The EU Projects Office was instrumental to secure the much-needed funding for the MCAST campus which is changing the entire infrastructural face of the college. A close collaboration of the Capital Projects Department was essential for the construction of main MCAST buildings: the Institute of Engineering and Transport building, the MCAST Resource Centre, and the Institute of Information and Communication Technology. This is a classical case of intra-collaboration of units to achieve a common target.

In terms of collaborative arrangements, MCAST registered a smaller number of collaborative agreements in the period under review, a total of 114. However, there is a strong increase annually. In fact, the number of collaborative arrangement tripled in just three years, from 2014 to 2016. The Partnerships Office was instrumental in establishing various MoUs with educational and industry partners and has become a UNESCO-UNEVOC Centre for TVET in Malta.
As can be noticed in Table 6, the UM absorbed a total of 52.6 million euro in EU research funds that constitute two-thirds of the present university’s annual budget. Funding has increased by more than two times from 2004 (2.9 million euro) to 2016 (6.6 million euro). MCAST absorbed a total of 62.5 million in EU funding that includes the structural funds and constitutes three times of total college budget. In just one year, 2013, the level of EU-funded projects was at the same level as that of the annual college budget.

Table 6. UM and MCAST funding. Author: Colin Borg (2018) – Data provided by the University of Malta, Project Support Office, and MCAST, EU Project Office

<table>
<thead>
<tr>
<th>Year Awarded</th>
<th>MCAST EU-Funded Projects (EUR)</th>
<th>UM EU Structural Funds</th>
<th>UM EU/International Research Grants (EUR)</th>
<th>UM Local Research Grants (EUR)</th>
<th>UM Total External Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>-</td>
<td>-</td>
<td>2,986,366</td>
<td>-</td>
<td>2,986,366</td>
</tr>
<tr>
<td>2005</td>
<td>-</td>
<td>-</td>
<td>2,103,876</td>
<td>416,492</td>
<td>2,520,368</td>
</tr>
<tr>
<td>2006</td>
<td>-</td>
<td>-</td>
<td>3,233,683</td>
<td>87,724</td>
<td>3,321,407</td>
</tr>
<tr>
<td>2007</td>
<td>2,457,132</td>
<td>-</td>
<td>1,105,812</td>
<td>249,471</td>
<td>1,355,282</td>
</tr>
<tr>
<td>2008</td>
<td>2,084,273</td>
<td>-</td>
<td>2,345,670</td>
<td>541,151</td>
<td>2,886,822</td>
</tr>
<tr>
<td>2009</td>
<td>1,570,318</td>
<td>-</td>
<td>2,194,819</td>
<td>165,228</td>
<td>2,360,047</td>
</tr>
<tr>
<td>2010</td>
<td>4,872,113</td>
<td>934,573</td>
<td>2,453,508</td>
<td>146,068</td>
<td>2,599,576</td>
</tr>
<tr>
<td>2011</td>
<td>5,191,593</td>
<td>8,765,445</td>
<td>5,439,061</td>
<td>809,098</td>
<td>6,248,158</td>
</tr>
<tr>
<td>2012</td>
<td>5,219,660</td>
<td>5,680,120</td>
<td>5,454,175</td>
<td>917,946</td>
<td>6,372,121</td>
</tr>
<tr>
<td>2013</td>
<td>15,867,354</td>
<td>7,950,960</td>
<td>5,080,716</td>
<td>943,663</td>
<td>6,024,379</td>
</tr>
<tr>
<td>2014</td>
<td>11,224,825</td>
<td>14,996,328</td>
<td>3,895,422</td>
<td>161,500</td>
<td>4,056,922</td>
</tr>
<tr>
<td>2015</td>
<td>13,990,294</td>
<td>8,141,585</td>
<td>4,157,686</td>
<td>1,113,019</td>
<td>5,270,705</td>
</tr>
<tr>
<td>2016</td>
<td>66,693</td>
<td>3,920,528</td>
<td>6,061,531</td>
<td>543,638</td>
<td>6,605,169</td>
</tr>
<tr>
<td><strong>Total Funds</strong></td>
<td><strong>62,544,259</strong></td>
<td><strong>36,889,539</strong></td>
<td><strong>46,512,323</strong></td>
<td><strong>6,094,999</strong></td>
<td><strong>52,607,322</strong></td>
</tr>
</tbody>
</table>

Laborious collaborative agreements are also in place in order to successfully achieve what are deemed as fundamental institutional performance targets such as an increase in the international students. The UM’s NOHA (Network on Humanitarian Action) joint master’s degree programme in International Humanitarian Action is a case in point. It involves a consortium agreement for the delivery of a joint intensive programme by eight different European universities: Marseille University, University College Dublin, Ruhr-Universitats Bochum, Universidad de Deusto, Uppsala University, Rijksuniversiteit Groningen, Uniwersytet Warszawski, and the UM. The joint master’s programme, which is spread over 4 semesters, intends to attract European, Canadian, Latin American, Indonesian, African, and Middle Eastern students. The crucial point is that, in order to attract a maximum of 25 international students, the universities had to create such a complex collaborative mechanism involving the contribution of so many different offices (Office of the Registrar, International Office, Scheduling Office, and Project Support Office) from each respective university.
Concluding Remarks: The Complexity of the Context

Two underlying aspects came out from the analysis conducted in this paper. First, contextual changes are multiplying the structures and increasing the staff within HEIs. This scenario is directly influencing the wide array of performance process indicators that could be potentially determined within institutions. If new structures are created to take care of academic programmes and funded projects, new performance indicators will be designed to assess the performance of these new units. The second underlying aspect is that the more complex the context, the more laborious are the structures and as a result it becomes more challenging to achieve the institutional and national performance targets.

Therefore, the drive towards managerialism brought about changing governing structures and decision-making processes. This managerial evolutionary change channelled HEIs in experiencing a paradox stemming from the development and multiplication of governing structures. The paradox involves the achievement of better performance on one hand and the creation of complex institutional designs and processes on the other hand. The challenges include the difficulty of achieving a widespread power distribution especially by allowing more students' and staff participation in decision-making, the risk of having slow decision-making as well as ambiguous objectives, vague values and principles in complex and chaotic conditions, ambiguity, weak communication, collaboration and coordination, competing entities, overlap, multiplication of effort, overregulation, unnecessary administration, diseconomies of scale, less academic freedom, and less sensitivity to the peripheral units. A separate paper is required to study this phenomenon.

Acknowledgements

I thank the University of Malta (UM) and the Malta College for Arts, Science, & Technology (MCAST) for kindly providing me with the data that is included in the tables of this chapter.

References


An Evaluation of the Implications of Thermography within the Healthcare Setting

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*Learning Support Unit (LSU), MCAST

Abstract: Thermography has developed rapidly over the past fifty years; it has been refined into a sophisticated tool to measure temperature that may be used anywhere owing to the reduction in size of the apparatus used. This technique has also been used industrially to ensure product quality. However, for over fifty years this technology has been employed in medical research studies as it is a non-invasive tool that can be used to study human skin temperature (Ring 2010). The body’s physiological mechanisms yield heat and temperature variations may indicate the presence of disease (Gatt et al. 2015). Thermography is not a tool that requires a skilled technician, nor is it a test that needs to be applied physically to the desired area. It is a simple test can be performed by a simple click of a button and the subject’s temperature readings can be uploading on the manufacturer’s software (Jones 1998). Repeatability of this test has been applied with successful results (Balbinot et al. 2013).

Over the past year, MCAST students in several faculties have observed first-hand the application of thermography as an indication of disease, making using the thermographic camera available on campus. Students from various disciplines could see how the heat-detecting camera being used for disease detection in addition to its applications in engineering, construction, and food technology. Using this research science and technology were linked to enhance the students’ learning experience and make them aware of a fresh approach on how humans can benefit from modern engineering in relation to health. The applications of thermography for disease detection and the understanding of its use is of the utmost importance for students following health-related courses, since thermography is a tool that may soon be available locally as research brings forth new beneficial practices in medicine. This paper appraises the importance of this tool within the health-care setting.

Keywords: Thermography; heat transfer; disease; identification.

The use of thermography in industrial manufacturing and quality control is well-known since it can easily detect heat variations; it is used within multiple fields, including building diagnosis to identify air leaks, electrical and mechanical engineering to detect insufficient insulating, marine electronics for navigation, and gas detection in the oil and gas industry (FLIR systems 2018), to name but a few. Thermography may detect defective materials in line operations, prevent outbreak of fires from stored flammable merchandise (Raytek 2010), and detect defects in printed circuit boards (PCB) in the initial stages (Spence et al. 1995).

However, thermography’s application in medicine shines a new light on disease diagnostics. Its use for medical applications involves the detection of emitted infra-red radiation from a body region of interest, typically the skin surface; different pathologies may cause inflammation and changes in the circulatory distribution,
thus changing the normal heat pattern of the body’s surface (Jones 1998). Modern thermographic equipment is extremely sensitive, designed to detect the smallest variations in infra-red emissions; still this technology is non-invasive and does not emit radiation which could harm the patient (Walker & Kaczor 2012). Since the development of thermometers in the 17th century, the need to assess temperature to identify disease has been recognized. Thermography was employed in the 1960s to study skin non-invasively although the equipment then available was bulky and noisy. The first study using thermography, conducted in the late 50s, was aimed to detect breast cancer before this was clinically obvious; however, the thermal camera used had a slow response and needed significant amount of space due to its bulkiness. Still thermography proved to be an effective tool for cancer detection (Bagavathiappan et al. 2009). Thermography has since come a long way in terms of reliability and modern thermographic imagers are smaller, have a greater resolution, and provide a speedy result that can be uploaded on a computer in seconds (Raytek 2010).

Having a reliable tool in the clinical area for identification of disease, further complications, or assessment of success following an intervention, increases the patient’s chances of survival. In cases of diabetes and poor circulation, this tool may be used to identify problems, such as the development of ulcers (Kanazawa et al. 2016) or identify conditions such as peripheral arterial disease (Gatt et al. 2018a).

Implementing such a tool that can determine whether an intervention is required through an accurate assessment of the perfusion to the areas of interest, most often the toes or the foot, ensures that patients who merit intervention achieve such intervention within time, while others are not subjected to the unnecessary risks of intervention.

Foot complications are common in patients with diabetes mellitus; staggering facts published by WHO (2015) state that diabetes will be the seventh leading cause of death in 2030 owing to its complications. The organization has also estimated that 1.5 million died owing to diabetic complications in 2012 and that 9% of the world’s population suffered from diabetes in 2014. Diabetic complications include blindness; kidney damage; cardiovascular disease and subsequently amputation of lower limbs; as well as ulcers that fail to heal, causing infection and gangrene and which may lead to minor or major amputations. Such consequences occurring because of the failure to foresee such complications cause increased hospital admissions and lengthy hospital stays (Comino et al. 2015) where diabetic foot disease is the leading cause of lower limb amputations and could be reduced by screening of the lower limbs and proper care (Bharara et al. 2010). Identification of poor perfusion may prevent people at risk, such as diabetics and patients with circulatory issues complications such as loss of function, immobility, or loss of limbs (Kaabouch et al. 2011). Recent publications have shown thermography to be a tool that can easily monitor peripheral temperature in the lower limbs to identify changes in disease (Gauci 2017); moreover thermal measurement has long been suggested as a way to identify foot problems in the health-care setting (Sun et al. 2005).

Temperature-regulation Processes

The human body regulates its core temperature by balancing the heat produced within the body with the heat lost, for the body to avoid hyperthermia or hypothermia; the body’s ability to regulate temperature by the central nervous system (CNS), depends on ambient conditions (Ammer & Ring 2000) and also in response to pathology (Greenwood et al. 2007). The body’s core temperature is regulated at 37 °C
normal conditions and is controlled by the autonomic nervous system by carrying signals to and from the CNS. Higher or lower temperatures may indicate disease or injury (Barriga et al. 2012) which could cause stress on the cardiovascular system (Frank et al. 1997).

Body heat is created in two ways: by digestion along with metabolism and heat produced by muscles, while the extremities gain heat by blood flowing through the cardiovascular system (Jones 1998). During metabolism, which comprises of anabolism and catabolism, heat is generated. During catabolism, large molecules divide into smaller molecules which is an exothermic process within the body. This process starts with digestion and ends within the cells where the energy is extracted for adenosine triphosphate (ATP) while further energy, which is more than half, is lost, aggravating the anabolic process that is vital in order to maintain a stable body temperature. This is kept constantly controlled by the hypothalamus that is part of the autonomic nervous system; specialized cells within the hypothalamus constantly adjust the body's temperature to maintain a set point of around 35.5ºC to 37.7ºC, depending on factors such as gender and time of the day (Vainer 2005). As the heart pumps blood through the arteries, gaining heat from organs, heat is consequently lost to peripherals mainly the skin, the dermis layers of which are connected with a network of capillaries. These are visible through a microscope even from the epidermis that connect to vessels that regulate blood-flow through vasoconstriction or vasodilation, causing heat loss through the skin (Luk et al. 1986). When the hypothalamus detects a slight temperature rise within the body, this structure reduces the internal core temperature through activating heat loss through vasodilation within the vessels, causing sweating that may reduce metabolic rate (Jones 1998). In turn when the hypothalamus detects a decrease in body temperature owing to environmental changes, the body experiences involuntary muscle movement causing shivering which builds up kinetic energy resulting in heat (Luk et al. 1986).

Temperature and Disease

In disease, temperature variations may be clinical indicators of the presence of inflammation, tumours, reduced circulation, and ulceration, amongst other conditions (Diakides & Jenkins 1995). Keeping the body's temperature constant is part of the cellular levels preservation process, which is known as homeostasis; even slight changes in the body's temperature indicate a disruption of this process (Jones 1998). Body temperature may increase or decrease, according to the particular cause. An elevated body temperature is usually caused by one of two processes: inflammation or carcinogenesis. Pathogen invasion could also lead to the innate immune system activating an acute inflammation, producing a higher peripheral temperature (Greenwood et al. 2007). Inflammation and venous flow alterations may result in a higher temperature of 0.7 to 1°C (Bagavathiappan et al. 2009) presenting in poor circulation owing to disease, such as artery obstruction; this will manifest itself in temperature differences in affected areas, leading to lower peripheral temperature.

A common condition in Malta is diabetes mellitus which significantly increases risks of lower limb problems as a result of lack of circulation and which may result in limb loss (Malmstedt et al. 2008). The island has one of the highest prevalence of diabetes mellitus in Europe, where the incidence rate is increasing steadily (WHO 2016). Left uncontrolled, the disease can lead to foot complications and consequent lower-limb amputations (Vinik 2003). Monitoring circulation to the limbs can be done at local clinics, although the precision of tools to identify such conditions in diabetics because of hardened arteries, a common affiliation among diabetics, has been debated
(Williams et al. 2005). A local study has investigated the tools currently used in the local general hospital and clinics to identify whether these devices efficiently identify circulation problems in a timely manner; it showed that these tools left many patients undetected (Formosa et al. 2013). Because of such unreliability, a local research group investigated infra-red thermography as a means to identify disease in the lower extremity. Thermography has already been used in several medical fields, including neurology, gynaecology, orthopaedics, dentistry, and vascular medicine. The local Diabetic Foot Research Group (DFRG) identified thermography as a valid screening tool to identify complications in the foot of diabetics (Gatt et al. 2018a,b).

Thermography Use and Implications

The first clinical thermometer was made over 200 years ago; its development helped clinical researchers discover knowledge that temperature changes in the body indicated progression of disease (Ring 2010). Thermal imaging is a non-contact measurement which detects infra-red thermal energy and converts that energy to an image to identify hot and cold spot variation (Raytek 2010). Thermography can capture real-time temperature as visual coloured thermal energy (Bharara et al. 2006). Skin temperature can be monitored using thermography as the blood vessels below the skin emit heat which the infra-red camera can detect. Thermography is now becoming a useful medical tool owing to lack of skin contact which minimizes the probability of cross-infection between patients and also because it is non-invasive; since patients experience no pain it increases client compliance (Bagavathippan et al. 2009). Thermographic images are not user-dependent, as long as all settings are set well, because images can be analysed through user-friendly software and the equipment to read it is within the normal price range for medical equipment (Ring 2010). Also thermography can recognize the slightest change in temperature as this tool is sensitive to the body’s biochemical processes (Deng & Liu 2004).

Thermography Features

Thermography can give valuable information and has been used for biomedicine for the past fifty years, although only currently has its application in medicine increased owing to thermography’s sensitivity and repeatability, along with the fact that the patient is not exposed to any harm (Bharara et al. 2006). Thermography is a technology of radiation that ranges between 0.75µm to 1000Qm within the range of human body emission. The traditional body infra-red rays range from 8µm to 12Qm; however, a more common term used is thermal infra-red where medical infra-red measures the wavelength beyond 1.4µm, as within this wavelength indicates thermal radiation (Bagavathippan et al. 2009). Thermography is based on the fundamental equation by Plank’s, Stefan Boltzmann, and Wein’s Displacement Law that link the absolute temperature of an object with the radiation emitted by its intensity and wavelength. Stefan Boltzmann Law is based on the following equation, were ε=emissivity and T= absolute temperature: W = εσ T^4.

The earlier infra-red cameras were inconvenient to use because of their large size; since they required liquid nitrogen cooling they could only be placed horizontally. Today’s cameras are smaller and do not need cooling; in fact, some cameras may even need to be warmed and they may be placed in any position making their application easier (Jones 1998). Current cameras are also cheaper; are manufactured using a technique of silicon wafer; have high temperatures ranges and spatial resolution; are electrically cooled, uncooled, or warmed; are small, portable, and compact; and may be used at any angle; and may be attached to a mobile device.
Thermography in Humans

Thermography can be used on humans as skin has an emissivity of 0.98, equivalent to a black body. The emissivity of a black body would show an emissivity value of $\varepsilon=1$, while non-black body objects would have an emissivity lower than one. Since a true black body emits and absorbs all wavelength energy perfectly, emissivity represents the energy radiated from the object versus the energy returned from a black body having the same temperature (AAT 2015). Human skin can modify body temperature according to its surroundings, as human skin keeps the body’s temperature constant at 37°C; however, in hot environments, skin absorbs heat, making the body sweat as a cooling mechanism, whereas when the skin is in a cooler environment, the skin is cooled and emits heat, therefore being a black body (Bagavathiappan et al. 2009). The rate by which heat is exchanged in the surrounding environment is held constant; moreover as blood flows through the body’s vessels, heat is transported to the skin creating a thermal transfer. The body maintains a thermal balance by losing heat to the surrounding environment through multiple factors, such as natural or forced convections, exhaling carbon dioxide, thermal conduction or convection, and evaporating sweat (Jones 1998).

Infra-red used in medicine for diagnostic purposes is based on the measurement of physiological changes, mainly when vasodilation, hyperthermia, hyperperfusion, hypermetabolism, and hypervascularisation take place. These physiological changes are evident in conditions such as carcinogenesis, rheumatoid conditions, fractures, pathogenic infections, skin conditions, and vascular diseases (Herrick & Hutchinson 2004). Furthermore research suggests that skin colour, gender, or burns trauma cause no difference in emissivity (Vainer 2005).

Thermography Settings

Infra-red thermographic images need to be set according to the specific type of material studied; for human skin, emissivity needs to be set at 0.98, while the camera needs to be calibrated against a black body at an emissivity of 1.0, for each reading or patient, for best reliability. Temperature control is a crucial part of the test, where ambient temperature needs to be set at a constant temperature between 20–21°C, with no airflow directed on the subject’s skin. Lower ambient temperature may cause the patient to shiver, causing movement and vasoconstriction which would affect the outcome or impeding accurate measurements, whereas a higher temperature may cause the patient to sweat, which could interfere with skin temperature analysis and vasodilation. Therefore the room with the apparatus should preferably have matte-finished non-reflective walls and no mirrors in the camera view. The camera needs to be set at precision autofocus and may be set to take photographic images superimposed in one snap shot for reference (AAT 2015), as seen in Figure 1.

Thermal images need to be acquired after allowing the subjects’ peripheral temperature to adjust to the room temperature, with a minimum of 15 minutes allowed for the blood pressure and body temperature to settle (Ring et al. 2000) and using a contrast back-drop around the limb to avoid processing errors and to obtain the best image (Gatt et al. 2015). In this way human skin can be distinguished from the backdrop because of differences in temperature radiation. The thermography images can then be uploaded onto the computer and analysed by using software provided by the camera’s manufacturers which allows all recorded data to be reported by thermal imaging inspection and temperature plots to be analysed in detail. This software provides detailed functions and controls to report and analyse thermal images with...
multiple anomalies, trends, and panorama images to give precise results. By using an automated segmentation algorithm, one can identify regions of interest, making the process much faster to analyse and reproduce (Gauci et al. 2017), allowing focus on the precise area to compare a patient’s image to a previous image, and identifying changes in the same subject. When collecting images of the sole of the foot, images need to be collected with the subject in a supine position and subsequently in a sitting position with the affected and unaffected feet exposed to ambient as shown in Figure 2.

Figure 1. A diagram of a patient lying in the supine position with plantar surface area exposed for thermographic imaging

Figure 2. Thermography set-up: An example of a subject in position for testing, with the camera set at a distance of 3-8 feet

Conclusion

Interest in the application of thermography in biomedicine has been gradually increasing (Nola et al. 2012) because abnormal temperature variations extracted from heat emitted by the body have been linked to disease (Armstrong et al. 2007; Ring 2010).

This tool shows promise in its application to improve the care of the diabetic foot since, due to the sensitivity of thermography (Nola et al. 2012), thermal imaging can pick up small body temperature variations. Thermography can also identify temperature changes which indicate the development of neuropathic ulcers (Gatt et al. 2018b), peripheral circulation obstruction (Ring 2010), and vascular reactivity (Wang & He 2010), which could all be applied to diagnostic medicine within the healthcare setting.
Temperature assessment promises to be a potentially useful addition to the currently available physiological tools and could, in particular clinical contexts, overcome the limitations of the other physiological tools. The major advantage of thermography is that its use requires little to no technical training, is acceptable to the patient, and does not involve patient contact; it is also quick to use and holds good potential for rapid screening uses and is particularly useful in busy clinical areas with a high turnover of patients. This tool could lead to a reduction in misdiagnosis of patients and could be used by all healthcare workers with minimum training, as the slight temperature variations could raise red flags indicating that further investigations are needed. Students in the healthcare sector need to be acquainted with this new technology as locally this tool is still being researched; however, its technology will soon be applied in actual practice.

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Colin Borg

An Evaluation of the Implications of Thermography within the Healthcare Setting
Cassandra Sturgeon