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### 1. Introduction

According to Gartner, Inc (2020), the analytics and business intelligence (B.I.) market was estimated at \$25.5billion in 2020. Modern-day organisations treat data as part of their business processes on which strategies can be built and shaped (Bačić and Fadlalla, 2016). Djerdjouri (2020) argues that data constitute a new class of economic asset, similar to currency or gold, and plays a critical role in several types of organisations to constitute a fundamental resource for development.

This coursework reviews some fundamental concepts of BI and analyses the current business model of a small pawnbroker located in Saint-Denis, Paris. It explores the implementation stages for an enhanced Decision Support System (DSS) using analytics for the company's online sale strategy.

### 2. Problem Description

AnonymousP (an anonymised name for this coursework) is a family-owned business that carries out its activities using basic DSS functionalities through a dated outsourced Customer relation management (CRM) application.

The business senior management team recognises the necessity of adopting analytic solutions for decision making. The owners acknowledged the need for support to manage the frequency of returning customers, resource relocation (to maximise profitability margin), the attraction of new shoppers and the company pricing optimisation strategy.

### 3. Literature review

Businesses are starting to recognise the opportunity and potential for exploiting their datasets to gain analytical insights and support decisions (Kunc and O'brien, 2019). However, the challenge lies in connecting data from multiple sources into coherent business insights by adding context, interpretation, and reflection (Davenport et al., 1998. cited in Maravilhas et al., 2019). This is where business analytics comes into play by enabling information conversion into knowledge for effective decision-making (Martínez-Martínez, et al., 2018)

Cui et al. (2007) view analytics as improving business performance by providing powerful assistance for the executives by enabling them to have actionable information (cited in Karthikeyan et al., 2019). Visualising and interpreting data are vital skills in today's competitive business world. Indeed, the use of analytics by including data visualisations and dashboards can allow AnonymousP to make decisions quickly (Aigner, 2013).

Businesses are making more sophisticated use of data over time. Research and advisory firm Gartner, Inc (2014). illustrates this evolution in a four-stage framework, as seen in figure 1

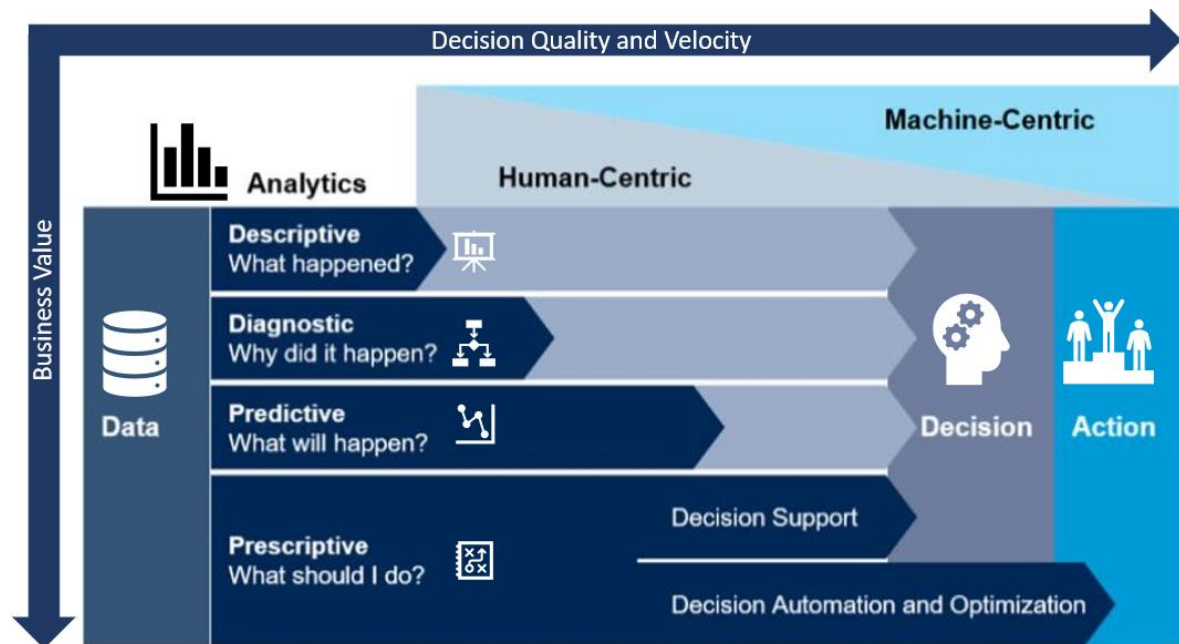


Figure 1: Four Types of Analytics Capability, adapted from (Gartner.com 2022)

In the model proposed by Gartner, the business value of data analytics increases as we move down the continuum from descriptive analytics to prescriptive analytics. So does decision-making quality and velocity, which increases by leveraging the more capable techniques and tools (even while human input decreases).

Power et al. (2018) describe analytics as applying models, methods, and tools to analyse data to gain insight to make informed decisions. Models include statistical models such as regression analysis, machine learning and data mining (via data clustering), and general models (Such as Monte Carlo simulation and Bayes theorem). Methods include visualisation and numerical outputs through graphs and charts. Tools include business analytic software (BAS) such as Power B.I., Excel, Tableau and other platforms, and programming languages such as DAX, Python, and R (Schniederjans et al., 2014).

#### 4. Proposed Methodology

The first activity in the proposed methodology was gathering, preparing, and analysing both internally and externally (from IMF, OECD, and UN) sourced data (International Monetary Fund, 2022; Organisation for Economic Co-operation and Development, 2022;

United Nations development programme, 2022). The Data was then transformed, cleansed, loaded and stored in the appropriate format; entries such as dates and states were reformatted where required. Excel and Power BI were preferred as they encompass continuity to the learning in the module, and little to no additional resources were required. A critical approach was adopted to avoid some biases attached to the interpretation of data (such as anchoring and confirmation biases).

Afterwards, we used a star schema model to classify data into assets and events. The star schema divides AnonymousP's data into two categories, namely dimensions, that provide detail about the product, customers, and attributes (such as colour, category and subcategory), and facts to include metrics, such as numbers that AnonymousP can aggregate to obtain insights (Ferrari and Russo 2017).

A set of quantitative reasoning techniques was explored, statistical functions and advanced analytics capabilities such as data displays using regression lines, box plots, percentiles, and reference lines for the median, mode, and mean values (Walther, ca. 2019; Camm et al., 2020). All four analytic capabilities described in the Gartner framework were explored from the most understood and widely used types of analytics to more complex models via pre-set functions and features proposed by Excel and Power BI.

## 5. Analysis

Numerous descriptive analytics techniques were initially deployed to understand past and current data trends, and fact-based decisions were made to explore some of the counterintuitive behaviours that were initially observed. Using descriptive analytics to categorise, characterise, aggregate, and classify data provided a helpful insight into the current business decisions and outcomes (Walther, ca. 2019)

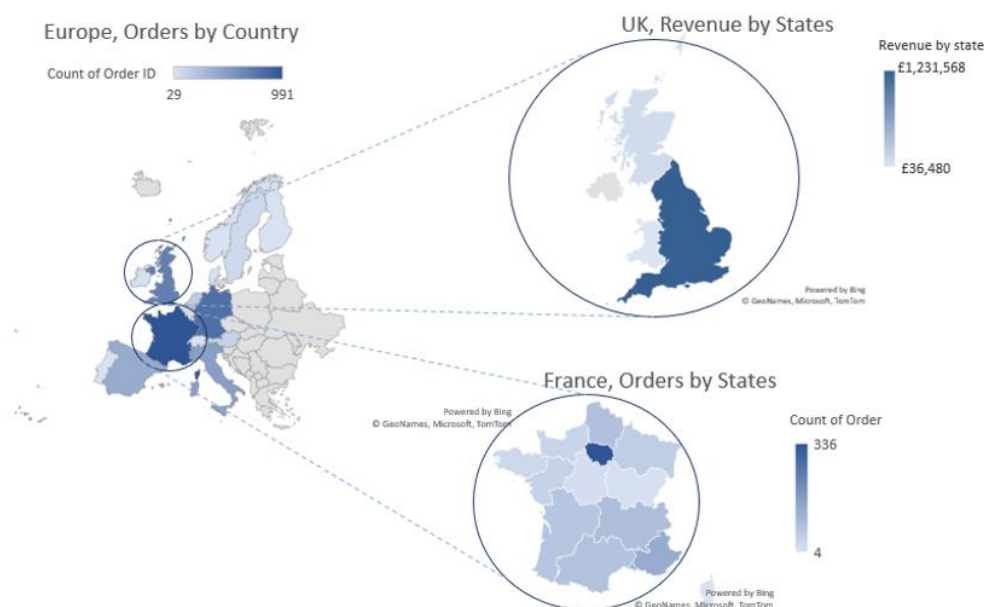


Figure 2: Order and Revenue by Country and States

Investigating sales trends with a Map chart in Figure 2 outlined some interesting patterns in locating the company's mainstream revenue. Associating those patterns with other variables can help the company to refine its sales strategies. For example, a Peer Group Analysis can provide further insights based on population characteristics and spending patterns, allowing AnonymousP to relocate its spending on marketing campaigns and freight tendering (Based on Sales volume by region). Historically, the company was not recording costs associated with delivering its product but including such records in their database is a recommendation to be considered.

Using moving average to identify trends in figure 3 did point out that sales for the company are seasonal. Such information can help adjust the sales budget currently used. Readjusting targets and budgets according to seasons will help the company optimise its margins.

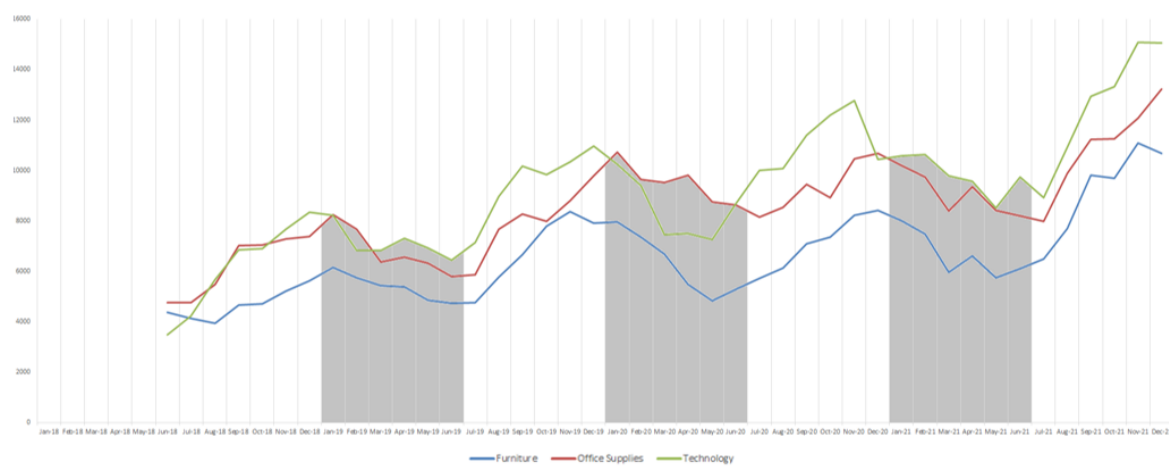


Figure 3: Revenue moving average by product category

We used the Correlation analysis in figure 4 to determine whether there was a relationship between variables and the strength of those relationships. This did outline that some of the current strategies adopted by AnonymousP, such as a discount offer to increase sales, were weakly or not correlated (Highlighted in Green in Figure 4). The relationship between those variables is expressed by the correlation coefficient ( $r$ ) (Wiyono et al., 2021.)

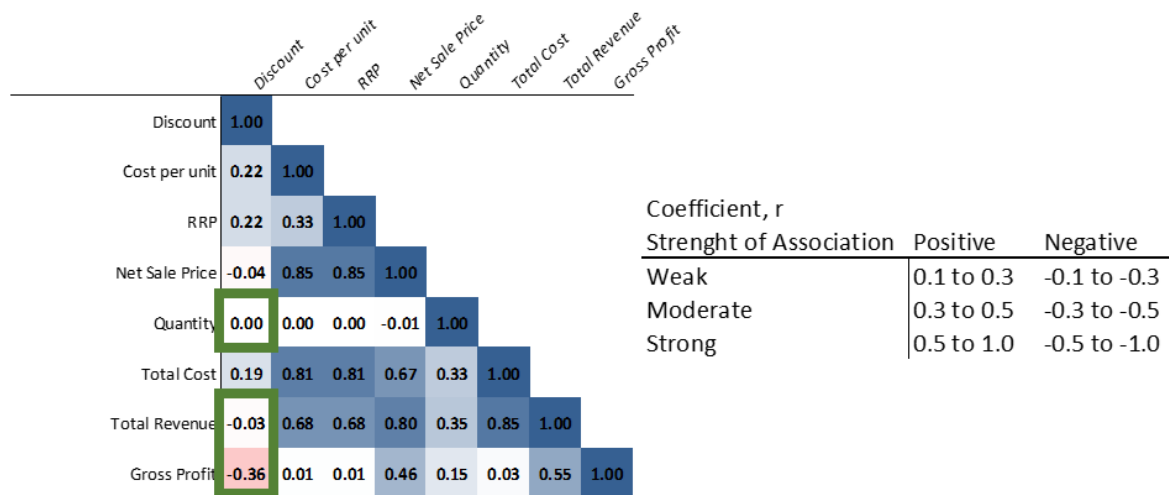


Figure 4: Correlation matrix

Segmenting returning customers into bins on a histogram did allow us to pinpoint bottlenecks in the company's ability to use discounts to boost its sales strategy. Figure 5.2 shows that customers making five or more visits spend twice more than customers with less than five visits. The company should consider wisely using discounts and other sales incentives to bond loyalty with returning customers, subsequently maximising revenue.

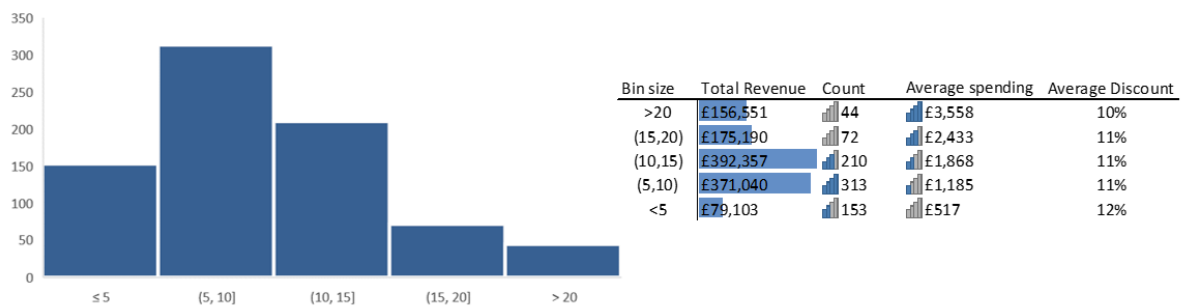


Figure 5.1: Returning customer histogram

Figure 5.2: Returning customer purchases

Predictive analytics can yield a substantial return on investment and help AnonymousP optimise its existing processes. Such tools can help the company to enhance its understanding of its customer behaviour, identify unexpected opportunities, and anticipate problems before they happen. Externally sourced data was included in a new regression model ( $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$ ) to provide a more coherent forecast of revenue than the one currently used by the company, but as seen in figure 6, none of the variables used was statistically significant and was therefore excluded from the forecasting model. This might be caused by the sample size not yielding valid results.

Country	Y 2021	X1 GDP	X2 Median Salary	X3 Mean Salary	X4 HDI	X5 Unemployment
Austria	£ 88,770.00	\$57,891.00	\$18,405.00	\$20,718.00	0.922	5.7
Belgium	£ 56,107.00	\$53,973.00	\$16,157.00	\$17,917.00	0.931	5.3
Denmark	£ 24,392.00	\$61,478.00	\$17,432.00	\$20,304.00	0.94	5.7
Finland	£ 5,927.00	\$51,867.00	\$16,332.00	\$18,742.00	0.938	8.4
France	£ 698,409.00	\$49,492.00	\$16,372.00	\$19,409.00	0.901	7.3
Germany	£ 498,143.00	\$56,956.00	\$16,845.00	\$19,730.00	0.947	4.5
Ireland	£ 27,798.00	\$99,239.00	\$14,520.00	\$17,938.00	0.955	5.8
Italy	£ 351,487.00	\$43,376.00	\$13,170.00	\$15,547.00	0.892	9.6
Netherlands	£ 126,631.00	\$60,461.00	\$17,154.00	\$19,690.00	0.944	2.9
Norway	£ 31,593.00	\$69,171.00	\$22,684.00	\$25,272.00	0.957	3.5
Portugal	£ 17,136.00	\$36,079.00	\$ 8,439.00	\$10,316.00	0.864	7.7
Spain	£ 294,388.00	\$41,546.00	\$11,786.00	\$13,822.00	0.904	13.3
Sweden	£ 82,643.00	\$55,398.00	\$17,625.00	\$20,193.00	0.945	8.9
Switzerland	£ 13,529.00	\$75,880.00	\$21,490.00	\$25,787.00	0.955	5.1
United Kingdom	£ 419,557.00	\$47,089.00	\$14,793.00	\$18,133.00	0.932	3.9

Regression Statistics					
Multiple R	0.583361912				
R Square	0.340311121				
Adjusted R Square	-0.026182701				
Standard Error	219897.4136				
Observations	15				

ANOVA					
	df	SS	MS	F	Significance F
Regression	5	2.24502E+11	4.49E+10	0.528558956	0.505496985
Residual	9	4.35194E+11	4.84E+10		
Total	14	6.59696E+11			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	846819.4038	3791987.161	0.223318	0.828274323	-7731251.514	9424890	-7731252	9424890
GDP	-8.998374426	6.296166842	-1.42918	0.186728474	-23.24129334	5.344544	-23.2413	5.344544
Median Salary	-191.000258	123.1525446	-1.55092	0.155333177	-469.5906689	87.59015	-469.591	87.59015
Mean Salary	186.4067775	115.5570737	1.613114	0.141177901	-75.00148436	447.815	-75.0015	447.815
HDI	-599116.1479	4557359.038	-0.13146	0.898302274	-10908578.54	9710346	-1.1E+07	9710346
Unemployment	-2888.056283	26656.04936	-0.10835	0.916098879	-63188.22926	57412.12	-63188.2	57412.12

Figure 6: Regression analysis ( $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e$ )

While the Regression analysis does consider external factors such as interest rate, GDP per capita and unemployment, other variables such as cost of deliveries, change in social behaviours, and competition were ignored.

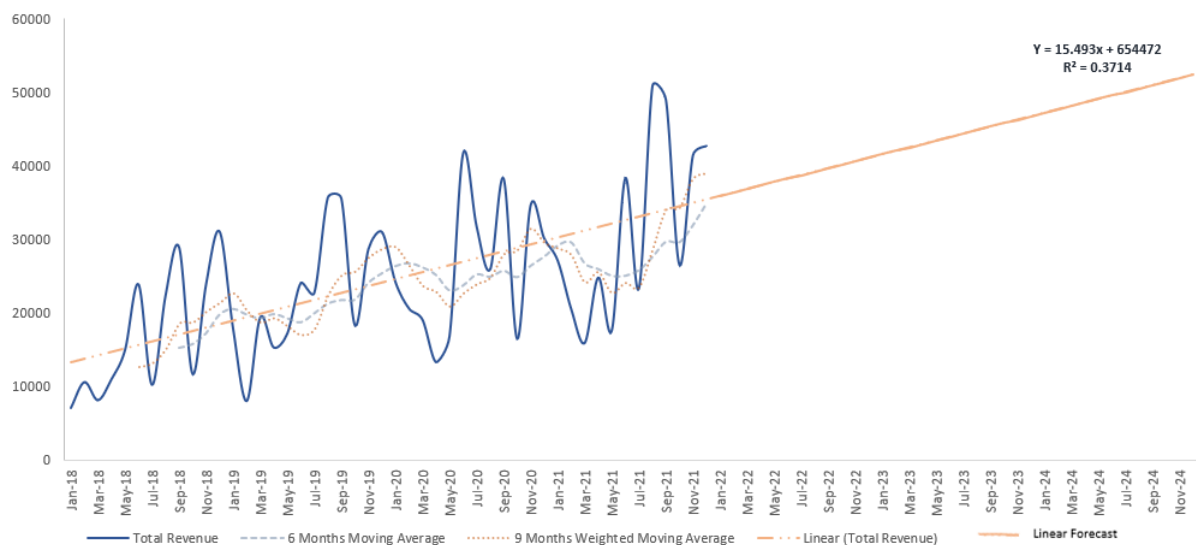


Figure 7: Linear Regression forecast ( $Y_i = \beta_0 + \beta_1X_i$ )

Additionally, while straight-line regression provides valuable insight into forecasting (Refer to Figure 7), it does not have the flexibility to accurately replicate the true arc form by most prediction models. AnonymousP should therefore consider keeping a record of additional information, such as website traffics and sales inventory turnover, which could be included in future predictive modelling

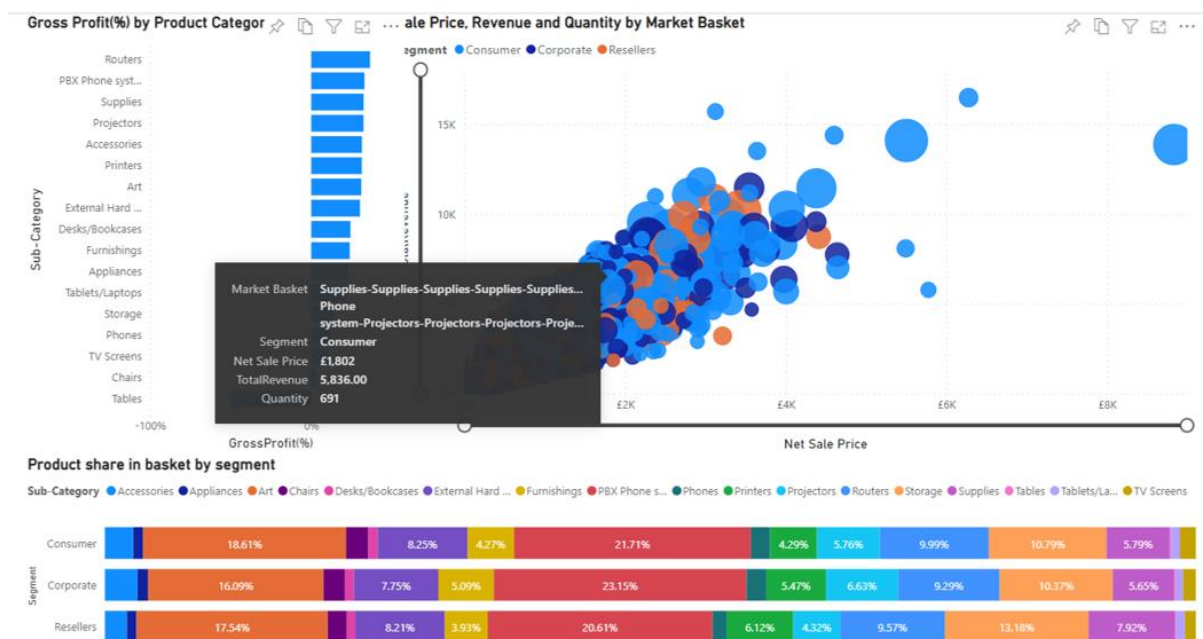


Figure 8: Market Basket Analysis using the sync function on Power BI

Prescriptive analytics can help the company to up-sell some of its customers. In Figure 8, a data mining scenario was replicated via the use of Power B.I. to predict customers' likely spending based on the analysis of previous baskets (Products previously bought together). The company can use techniques such as association analysis to place products close to each other in-store or suggest a second product when a consumer places their merchandise in their online cart (Camm et al., 2020).

## Conclusion

Business Analytics empowers AnonymousP to make well-informed business decisions and can therefore be a source of competitive advantage (Dereli et al, 2021). This is particularly true if the company can extrapolate information and indicators from internal and external environments to make accurate forecasts based on trends and conditions. Despite being in its nascent stage of use, business analytics has the potential to significantly improve outcomes and decision-making quality and drive cost-efficiency for the company.

Finally, while it is true that the algorithms and concepts covered in this coursework may have been used for a while, it is only recently that information technology with the desired level of sophistication and advancement has become available to smaller businesses. The discipline of analytics can rapidly mature as businesses embrace its potential.

### List of Acronyms:

BAS: Business analytic software

BI: Business intelligence

CRM: Customer Relation Management system

DAX: Data Analysis Expressions

DSS: Decision Support System

IMF: International Monetary Fund

IS: Information systems

OECD: Organisation for Economic Co-operation and Development

UN: United Nations

### References:

Aigner, W., (2013). July. Current Work Practice and Users' Perspectives on Visualization and Interactivity in Business Intelligence. In 2013 17th International Conference on Information Visualisation (pp. 299-306). IEEE.

Bačić, D. and Fadlalla, A., (2016). Business information visualization intellectual contributions: An integrative framework of visualization capabilities and dimensions of visual intelligence. *Decision Support Systems*, 89, pp.77-86.

Camm, J.D., Cochran, J.J., Fry, M.J. and Ohlmann, J.W., (2020). *Business analytics*. Cengage Learning.

Cui, Z., Damiani, E. and Leida, M., (2007), February. Benefits of ontologies in real time data access. In 2007 Inaugural IEEE-IES Digital EcoSystems and Technologies Conference (pp. 392-397). IEEE.

Davenport, T.H., De Long, D.W. and Beers, M.C., (1998). Successful knowledge management projects. *MIT Sloan Management Review*, 39(2), p.43.

Dereli, S.E., Korthaus, A., Scheepers, H. and Ahmed, A., 2021. The Role of Business Analytics Capabilities in Enabling Competitive Advantage for SMEs.

Djerdjouri, M., (2020). Data and Business Intelligence Systems for Competitive Advantage: prospects, challenges, and real-world applications. *Mercados y Negocios: Revista de Investigación y Análisis*, (41), pp.5-18.



Ferrari, A. and Russo, M., (2017). Analyzing Data with Power BI and Power Pivot for Excel. Microsoft Press.

Gartner Inc., (2022). Four Types of Analytics Capability 2014, [Online Image]. Available from: <https://www.gartner.com/en/newsroom/press-releases/2014-10-21-gartner-says-advanced-analytics-is-a-top-business-priority> (Accessed: 28 March 2022).

Gartner Inc., (2022). Gartner Top 10 Data and Analytics Trends for 202. <https://www.gartner.com/smarterwithgartner/gartner-top-10-data-and-analytics-trends-for-2021>. (Accessed: 19 April 2022)

Gartner Inc., (2022). Market Share: Data and Analytics Software, Worldwide, 2020 <https://www.gartner.com/en/documents/3464843> (Accessed: 30 March 2022)

International Monetary Fund., (2022). World Economic Outlook database: April 2022. <https://www.imf.org/en/Publications/WEO/weo-database/2022/April/download-entire-database> (Accessed: 19 April 2022)

Karthikeyan, C. and Benjamin, A., 2019. Meta Analytical Literature Study on Business Intelligence and Its Applications; a Techno-Business Leadership Perspective. International Journal of Research in Social Sciences, 9(4), pp.240-262.

Kunc, M. and O'brien, F.A., (2019). The role of business analytics in supporting strategy processes: Opportunities and limitations. Journal of the Operational Research Society, 70(6), pp.974-985.

Maravilhas, S. and Martins, J., 2019. Strategic knowledge management in a digital environment: Tacit and explicit knowledge in Fab Labs. Journal of business research, 94, pp.353-359.

Martínez-Martínez, A., Suárez, L.M.C., Montero, R.S. and del Arco, E.A., (2018). Knowledge management as a tool for improving business processes: An action research approach. Journal of Industrial Engineering and Management, 11(2), pp.276-289.

Organisation for Economic Co-operation and Development., (2022) Annual wages 2018 -2021. [https://stats.oecd.org/Index.aspx?DataSetCode=AV\\_AN\\_WAGE](https://stats.oecd.org/Index.aspx?DataSetCode=AV_AN_WAGE) (Accessed: 19 April 2022)

Power, D.J., Heavin, C., McDermott, J. and Daly, M., (2018). Defining business analytics: An empirical approach. Journal of Business Analytics, 1(1), pp.40-53.

Schniederjans, M.J., Schniederjans, D.G. and Starkey, C.M., (2014). Business analytics principles, concepts, and applications: what, why, and how. Pearson Education.

United nations development programme., (2022) Human Development Reports 2018 - 2021. <https://hdr.undp.org/en/global-reports> (Accessed: 19 April 2022)

Walther G., (ca. 2019). Stanford University, Introduction to Statistics. Coursera.org learning platform [online]. <https://www.coursera.org/learn/stanford-statistics/home/welcome> (Accessed 27 February 2022)

Wiyono, W., Christian, P.Y. and Abidin, A., (2021). Simple linear correlation and regression analysis using Microsoft excel and its application in marketing management. *Akselerator: Jurnal Sains Terapan dan Teknologi*, 2(1), pp.29-40.