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## CONSEQUENCES OF MONETARY POLICY FOR CREDIT RISK IN THE USA

MÁRIA BOHDALOVÁ<sup>1\*</sup> AND MARTIN PAŽICKÝ<sup>2</sup>

### ABSTRACT

Financial institutions have experienced various difficulties for many years; this is the main reason why every bank should be aware of its credit risk evolution in order to set objectives governing the bank's lending. The purpose of our paper is to characterise the credit quality of US banks using transition probability matrices constructed using Markov chains. The stationarity of credit migration probability is conditioned by macroeconomic development and monetary policy. We monitor the likelihood of migration among credit classes based on short-term trends in output gap and the Fed Fund rate. We claim that there is a certain relation between the two monitored parameters and the credit standards of the clients. In addition, we found evidence of the market's lessons from the global financial crisis in 2008 when the markets did not capture a deterioration in credit quality.

**Keywords:** Monetary policy, Transition probability matrix, Credit risk, Markov chains.

### INTRODUCTION

Since the economic collapse in 2008 known as the global financial crisis, caused inter alia by the mortgage bubble and the failure of credit rating systems, attention has been paid to the reliable identification of credit risks. As a consequence, not only have the fiscal, monetary and financial policies of advanced economies changed, but the banking sector has been tightened. The long period of liberalisation in the banking sector has changed into a period of more stringent regulation known as the Basel rules.

Renowned rating agencies create rating scores based on quantitative estimates for measuring of exposure at default (EAD), loss given default (LGD) and recovery rate (RR). These statistical measures are used to determine the rating for a given entity. Ratings thus incorporate qualitative and quantitative components (Brown, 2004). An alternative model estimating credit risk incorporates transition matrices of Markov chains. The unique feature of Markov chains allows us to investigate discrete time series based on the stochastic process. It is possible to estimate the change between two neighbouring observations and to compute probability of such a change ignoring the history of the time series. As Jones (2005) has written, these models of migration rating show the evolution of creditor quality for broad groups of creditors with the same approximated likelihood of default.

Markov chains have become extremely popular for risk measurement purposes, especially in recent years. There are several examples of applying Markov chains in different areas, such as learning models of bird migration from citizen science count data (Sheldon et al., 2013; Liu, Sheldon and Dietterich, 2014), learning models of human mobility from data that is aggregated to maintain privacy (Sun, Sheldon and Kumar, 2015), and fitting models of voter turnout and demography from census data (King, 2013; Flaxman, Wang and Smola, 2015). Markov transition matrices are increasingly used in finance to determine credit risks or bond ratings; see, for example, Chang, Fu and Kao (2017), for the measurement of credit quality of corporate bonds; Chan, Wong and Zhao (2010) who computed firm-specific

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transition probabilities; Laurent, Sestier and Thomas (2016) who designed a banking internal model using a two-factor model; or Liang, Zhao and Zhang (2016), who focused on the corporate bond rating system using Markov chains.

The study closest to our research is that of Jones (2005), who modelled credit risk from historical data on the proportions of institutions with different credit ratings. Jones claims that his model is ideal for credit risk applications where there is a paucity of data on changes in credit quality, especially at the aggregate level. The author uses a generalised least square (GLS) methodology to provide estimates of transition matrices for the United States using both non-performing loan data and interest coverage data for the period 1984-2004. The model is used to condition the matrices on economic fundamentals and stages of the economic cycle (Jones, 2005). Similar research was conducted by Bangia, Diebold and Schuermann in 2000. Focusing on the turmoil in the capital markets in 1997 and 1998, they conclude that underlying macroeconomic volatility is a key part of a useful conceptual framework for stress-testing credit portfolios, and that credit migration matrices provide the specific linkages between underlying macroeconomic conditions and asset quality. Credit quality of obligors is characterised by credit migration matrices designed based on Markov chains theory (Bangia, Diebold and Schuermann, 2000). For more examples of Markov chains usage see Hu, Liang and Wu (2015) or Bernstein and Sheldon (2016).

Looking at advanced economies, Chi and Li (2017) used data for Chinese commercial banks from 2000-2014. Their paper examined the effects of economic policy uncertainty (EPU) on banks' credit risks and lending decisions. Their results indicate that EPU increases banks' credit risks and negatively influences loan size (Chi and Li, 2017). Vassiliou (2013) explored the rating system used by credit agencies with a focus on problems that justify the use of fuzzy set theory. The author models the evolution of credit migration of defaultable bonds as an inhomogeneous semi-Markov process with fuzzy states. The research was extended later by modelling the migration process of defaultable bonds as a different inhomogeneous semi-Markov model. The survival probabilities of a defaultable bond in every credit grade were found (Vassiliou, 2014). There are various papers assessing credit risk using transition matrices: see, for example Kunovac (2011) for the evidence from Croatia; Jackuliak (2014) using US data; Jackuliak and Bohdalová (2017) investigating credit standards in Slovakia and the Czech Republic; or Walshe (2016) using the first-order Markov model in Ireland and the UK.

There are several studies investigating the consequences of monetary policy for the banking sector and credit quality in the economy. For example, Borio, Gambacorta and Hofmann (2015) claim that unusually low interest rates and an unusual flat term structure erode bank profitability. A different study investigated the effect of relatively loose monetary policy on bank risk through a large panel including quarterly information from listed banks operating in the EU and US. The research revealed that relatively low levels of interest rates over an extended period of time contributed to an increase in a bank risk (Altunbas, Gambacorta and Marque-Ibanez, 2014). In terms of the euro area, it was found that lower overnight rates soften bank credit standards, both for the average and for the riskier loans. The softening of credit standards was identified over and above an improvement of the quality of borrower's industry and collateral (Maddaloni, Peydró and Scopel, 2008). Research conducted by Maddaloni and Peydró (2013) provides evidence of excessive risk-taking for mortgages. The low interest rates after the 2008 crisis helped to ease lending conditions that were tightened due to bank capital and liquidity constraints, especially for business loans (Maddaloni and Peydró, 2013).

Despite the fact that a number of studies have been carried out on the credit risks subject, our paper contains several innovations that could potentially contribute to the topic of

credit risks. The benefits of our research are threefold. First, we focus on measuring credit risks in the US economy just after the end of monetary easing that was conducting since the global financial crisis in 2008. The US economy, compared to the euro area, is mature enough to start monetary tightening. It is therefore likely that the US model will become a stronger pattern for the euro area economy, as we have already witnessed. Second, we use Markov transition matrices to estimate credit risks. Although the method is known, it is not a common practice for credit risk measurement. The most important advantage of this method is its applicability to other economies under different conditions. Third, we condition transition matrices not only on economic cycle but also on monetary policy decisions. We are convinced that the combination of Markov theory as an estimation method in connection with monetary policy dynamics creates the most significant innovation of our paper.

The remainder of this paper is organised as follows. The next two sections outline methodological application and the data used in our research whereas the final two present our results and conclude the paper.

## METHODOLOGY

The theory of Markov chains is based on the stochastic process principle. The key idea of the Markov chains is that the conditional distribution of the probabilities of the system in the next step as well as other steps in the future depends only on the current state of the system and not on the states of the system in the previous steps. For estimating transition matrices we will apply a similar procedure proposed by Jones (2005).

Markov transition matrices for credit risk modelling is a known methodology that is based on aggregated proportional data. This method is used in the absence of data on credit quality changes, especially at the aggregate level.

The Markov transition probability model defines a set of qualitatively discrete classes in which individual objects are classified. We will define a transition matrix, denoted as  $P = [p_{ij}]$ , which reflects the probability of sustaining in a given class or the probability of changing the category to the remaining  $R - 1$  classes over the observed period. The individual components of the transition matrix  $p_{ij}$  indicate the probability of a credit rating equal to  $i$  at time  $t - 1$  and the credit rating  $j$  at time  $t$ .

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1R} \\ p_{21} & p_{22} & \cdots & p_{2R} \\ \vdots & \vdots & \ddots & \vdots \\ p_{R1} & p_{R2} & \cdots & p_{RR} \end{bmatrix}, \quad (1)$$

The key assumption is that once the rating in the worst credit class (i.e. the last column in the matrix shown in equation 1) is reached, it is no longer possible to improve the quality and change the credit class. This is because the last category represents failed loans that have already been written off. The last column thus represents the so-called ‘absorption vector’.

If the data for individual rating changes is available (i.e. the rating of the selected group of institutions is known at the beginning of the period and at the end of the period), then the probability of changing the initial rating is simply calculated based on the following equation:

$$P_{ij} = \frac{n_{ij}}{\sum_j n_{ij}}, \quad (2)$$

where  $p_{ij}$  represents the probability of changing the rating  $i$  at time  $t - 1$  to the rating class  $j$  at time  $t$  and  $n_{ij}$  represents a total number of institutions, which had the rating  $i$  at time  $t - 1$  and rating  $j$  at time  $t - 1$ .

Unfortunately, we do not observe the actual count of transitions from adjacent credit categories. Our dataset consists only of the aggregate proportions,  $y_j(t)$  and  $y_i(t - 1)$ , which represent the proportion of observations with credit quality  $j$  and  $i$  respectively. We can then write a stochastic relation connecting the actual and estimated occurrence of  $y_j(t)$  as follows:

$$y_j(t) = \sum_i y_i(t-1)p_{ij} + u_j(t), \quad (3)$$

where  $p_{ij}$  shows the probability of credit quality being equal to  $i$  in period  $t-1$  and credit quality equal to  $j$  in period  $t$ ;  $u_j(t)$  represents an error term with credit quality  $j$  in time period  $t$ .

As proposed Lee, Judge and Zellner (1970), equation (3) can be written in matrix form as follows:

$$y = Xp + u, \quad (4)$$

where the vector  $y$  is characterised by proportions of the selected rating over time as follows:

$$y = [y_1 y_2 \dots y_{R-1}]^T \\ = [y_1(1), y_1(2), \dots, y_1(T) \quad y_2(1), y_2(2), \dots, y_2(T) \quad \dots \quad y_{R-1}(1), y_{R-1}(2), \dots, y_{R-1}(T)] \quad (5)$$

a matrix  $X_j$  consists of individual rating vectors, for  $j = 1, 2, \dots, R-1$ ,

$$X_j = \begin{bmatrix} y_1(0) & y_2(0) & \dots & y_R(0) \\ y_1(1) & y_2(1) & \dots & y_R(1) \\ \vdots & \vdots & \ddots & \vdots \\ y_1(T-1) & y_2(T-1) & \dots & y_R(T-1) \end{bmatrix}, \quad (6)$$

after modification, we obtain the following matrix  $X$  in a block-diagonal form:

$$X = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & X_{R-1} \end{bmatrix}. \quad (7)$$

We define the vector of estimated transition probabilities  $p$  as follows:

$$p = [p_1 p_2 \dots p_{R-1}]^T \\ = [p_{11}, p_{21}, \dots, p_{R1} \quad p_{12}, p_{22}, \dots, p_{R2} \quad \dots \quad p_{1,R-1}, p_{2,R-1}, \dots, p_{R,R-1}]^T, \quad (8)$$

and the vector of error terms  $u$  is given as follows:

$$u = [u_1 u_2 \dots u_{R-1}]^T \\ = [u_1(1), u_1(2), \dots, u_1(T) \quad u_2(1), u_2(2), \dots, u_2(T) \quad \dots \quad u_{R-1}(1), u_{R-1}(2), \dots, u_{R-1}(T)] \quad (9)$$

To estimate transition probability matrix  $P$ , we apply the OLS (Ordinary Least Squares) method. We need to solve the quadratic problem with linear constraints:

$$\text{minimize } u^T u = (y - Xp)^T (y - Xp), \quad (10)$$

when the linear constraints are met

$$\sum_{j=1}^{R-1} p_{ij} \leq 1$$

and

$$\sum_{j=1}^{R-1} p_{Rj} = 0$$

and

$$p_{ij} \geq 0.$$

We can rewrite the equation (10) in a matrix form as follows:

$$\text{minimize } u^T u = (y - Xp)^T (y - Xp), \quad (11)$$

with the constraints:

$$Gp \leq \eta$$

and

$$p \geq 0$$

and

$$G_{R \times R(R-1)} = [I_1 I_2 \dots I_{R-1}]$$

and

$$\eta_{Rx1} = [1 \ 1 \ \dots \ 1 \ 0]^T .$$

In this notation, the matrix  $G$  is  $R \times R (R - 1)$  matrix of given constraints. The matrix  $G$  is composed of  $R - 1$  identity matrices of the dimension  $R$ .  $\eta$  represents  $R \times 1$  column vector of ones, with a zero in last row to ensure that the loss state in the default category is absorbing. The system of  $R \times T$  equations serves to estimate the  $R \times R$  unknowns probabilities based on  $T$  observations. It is possible to find a transition probability matrix  $P$  when we assume that  $T \geq R$ . The last row of transition probability matrix  $P$  is computed using the following equality:

$$p_{iR} = 1 - \sum_{j=1}^{R-1} \hat{p}_{ij} . \quad (12)$$

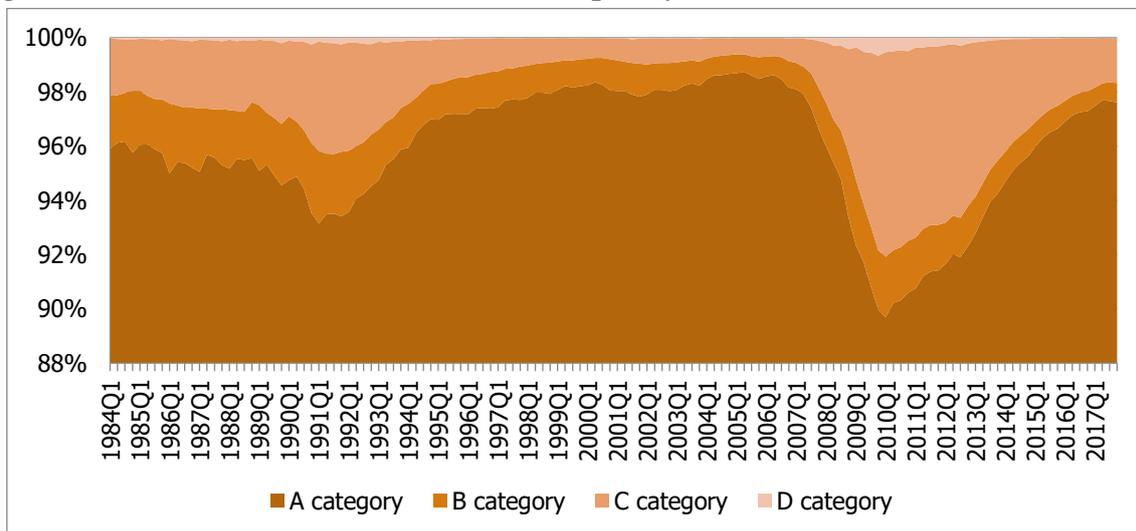
## DATA

For transition matrices estimation we obtained quarterly data on non-performing loans for the United States for the period 1984-2017, which yields 136 observations. The data source is FDIC's Statistics on Banking. Our dataset covers all US commercial banks that are insured by FDIC. Information on non-performing loans is broken down into several categories, but we focus solely on total real estate loans. We define four credit quality categories:

- **Category A:** performing loans and leases.
- **Category B:** loans and leases past due 30-89 days.
- **Category C:** loans and leases past due 90 days or more, including loans and leases in non-accrual status.
- **Category D:** cumulative charge-offs on loans and lease.

Credit quality evolution is illustrated in Figure 1.

**Figure 1. Real estate loans in the US - credit quality**



Source: own prepared based on FDIC data.

Figure 1 shows that credit quality of real estate loans in the US follows the business cycle. For more detailed information, see Appendix A, where data characteristics are captured.

In order to estimate condition transition probability matrices, we have collected data representing macroeconomic and monetary variables. Macroeconomic conditions reflecting the business cycle are approximated by output gap. To estimate an output gap, we have used a well-known Hodrick-Prescott filter, which is a mathematical technique used to smooth non-linear data points in time series. A substance of the Hodrick-Prescott filter is an assumption

that the original output (GDP) denoted as  $y_t$  is composed of a trend component  $\tau_t$  and a cyclical component  $c_t$ , which can be written as follows

$$y_t = \tau_t + c_t, \quad t = 1, 2, \dots, T. \quad (13)$$

Hodrick and Prescott (1997) suggested a way to isolate  $\tau_t$  and  $c_t$  by solving a following minimisation problem:

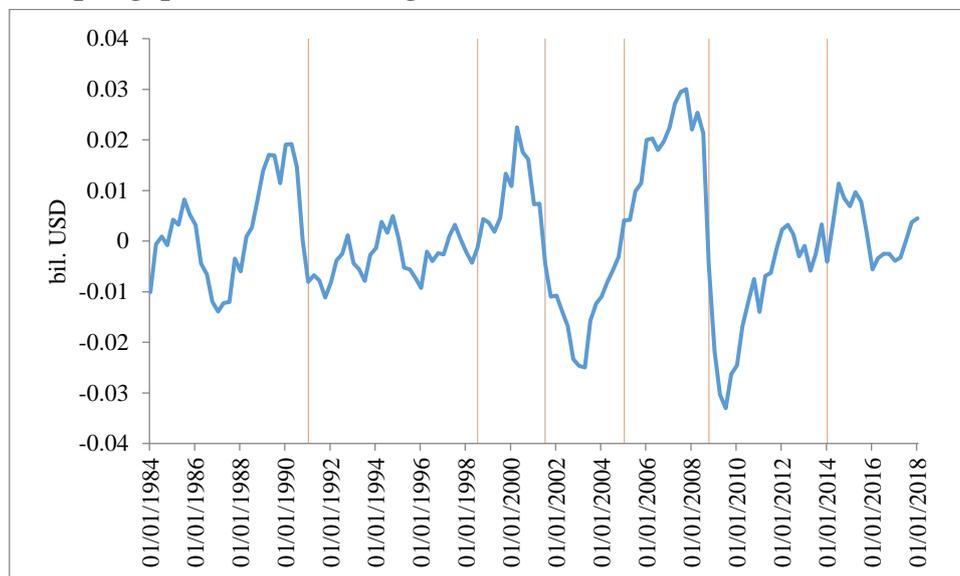
$$\text{Min}_{\{\tau_t\}_{t=1}^T} [\sum_{t=1}^T (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} (\nabla^2 \tau_{t+1})^2], \quad (14)$$

where  $\lambda$  is the penalty parameter. The first term is the loss function penalises the variance of  $c_t$ , while the second term puts a prescribed penalty to the lack of smoothness in  $\tau_t$ . Cyclical component representing the output gap can be then identified as follows

$$c_t = y_t - \tau_t. \quad (15)$$

During the periods when the output gap is positive, the real output is above the potential level meaning what means, the economy is going well. Negative output gap indicates contractionary times. Output gap in the USA over the examined period is captured in Figure 2.

**Figure 2. Output gap as a conditioning variable**



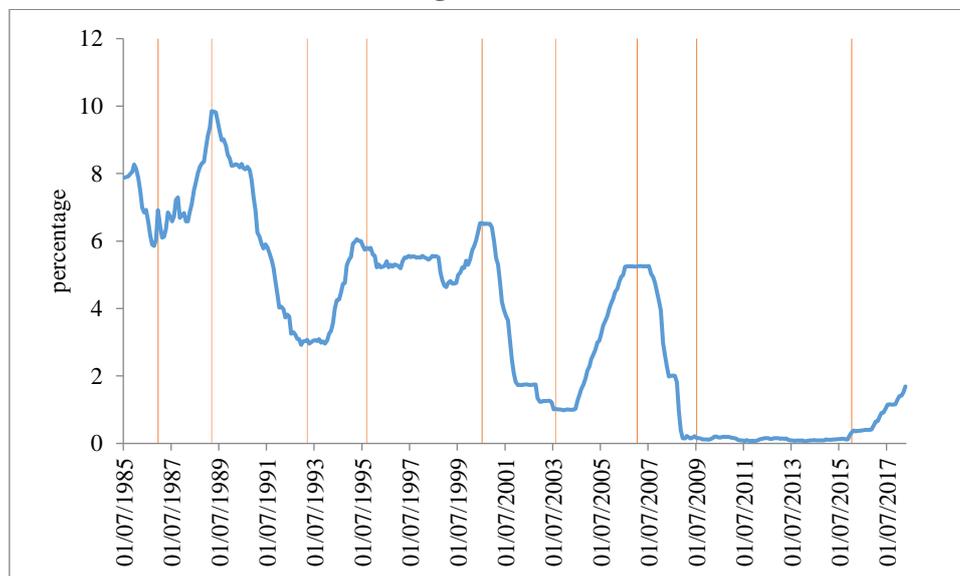
Source: own prepared based on FRED data.

The entire period is divided into 7 sub-periods depending on short-run trends. During the first period, an output gap was mostly positive. The second period exhibits a near stable output gap close to zero. Subsequently, we can observe periods with positive followed by negative, positive and then again negative output gap. Finally, in the recent times, the output gap is again positive. We have estimated seven separate transition probability matrices, each capturing a credit stance in an examined sub-period based on output gap. Although the Hodrick-Prescott filter has a couple of drawbacks, it is a sufficient tool to estimate output gap in this case.

In relation to monetary policy, we use the Fed Fund rate as a conditioning variable. The Fed Fund rate affects the cost of borrowing and, therefore, it is crucial to verify the relationship between Fed Fund rate and credit conditions. The Fed Fund rate is shown in Figure 3. As it is evident from Figure 3, we have identified 10 episodes with different trends over the entire period. The trends were determined using the  $F$ -test, which was performed to identify the break-even points when variance in the time series starts to be significantly different from the previous group of observations. When the  $F$ -test indicated a significant change in variance we have recorded this event on the time axis and we have used this

discrete time point as break-even. Using a group of 10 observations we came to 10 different sub-periods. Notwithstanding the fact that we lost 10 observations on the beginning (i.e. degrees of freedom),  $F$ -test is a good method to identify substantial changes in our dataset.

**Figure 3. Fed fund rate as a conditioning variable**



Source: own prepared based on FRED data.

GDP data and Fed Fund rates are obtained from the Federal Reserve Economic Database (FRED). Detailed data description is available in Appendix B.

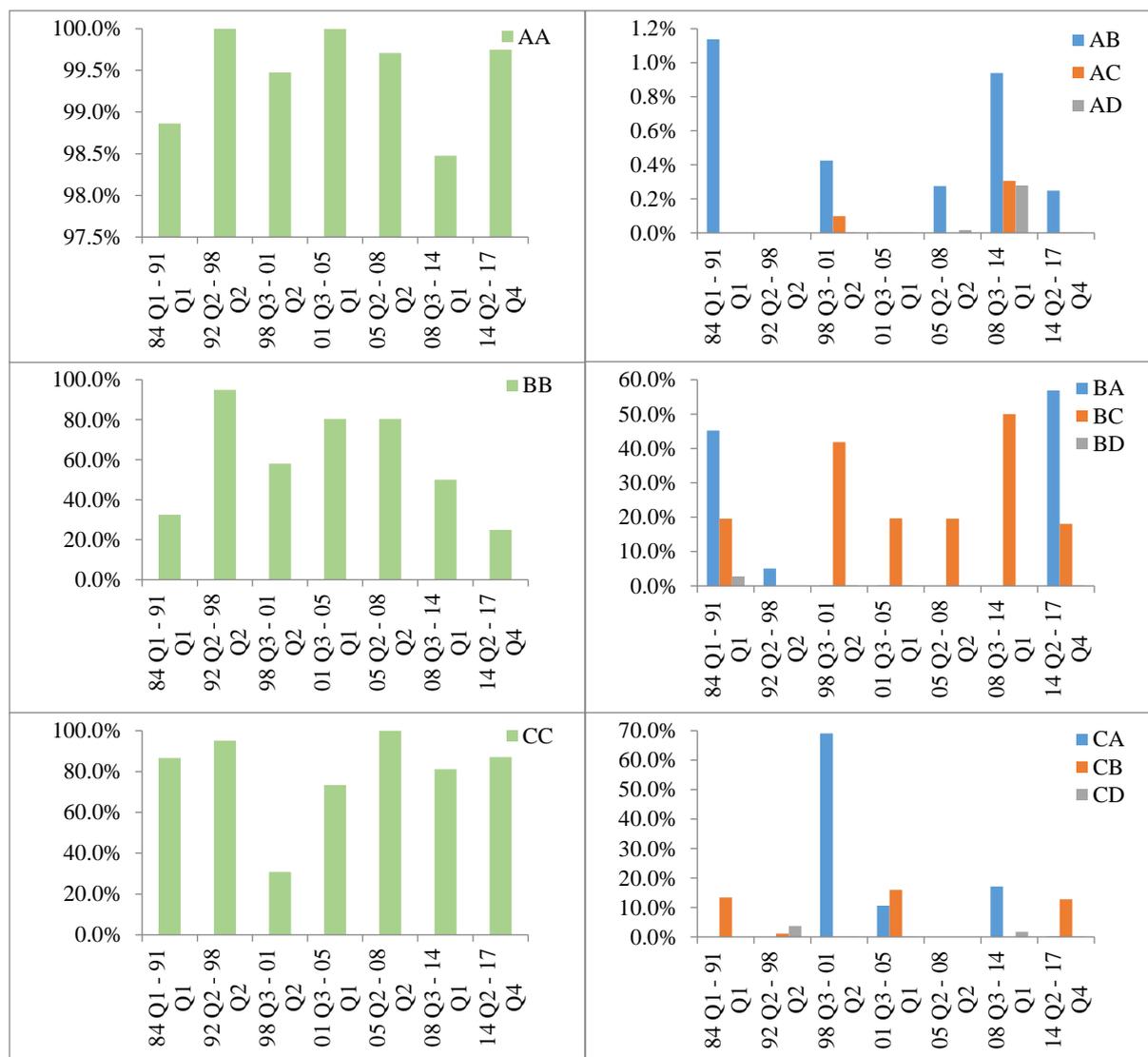
## RESULTS

This paper provides the answer to the central question: what is the probability of a performing loan becoming non-performing and vice versa? The question relates to the dynamics of credit quality in the USA under macroeconomic conditions measured by the output gap and US monetary policy measured by the Fed Fund rate. The associated transition probabilities have been estimated based on the assumption that a usual credit follows a first-order Markov chain of credit quality. We assumed that the estimated transition probabilities are not fixed throughout the entire sample, and therefore we have estimated several models based on distributions of the conditioning variables (i.e. output gap and Fed Fund rate). We consider the transition estimates to be a useful input into a broad range of credit risk models.

Figure 4 shows the lending and leaseback dynamics divided into sub-periods according to the results of the output gap period (i.e. Figure 2). The probabilities to remain in the same credit category are captured in the left column. The borrowers rated in category A have a very high probability to meet their debts on time and stay in the same category. It is clear that borrowers kept very high credit standards over the period from Q2 1992 to Q2 1998, when the output gap was relatively stable and was close to zero. During this period, it was very likely to keep the actual rating (e.g. the probability of staying in A, B or C categories was almost 100%) and there was almost zero probability of default. The results captured in Figure 4 do not indicate that credit conditions were more favourable during periods of positive output gap and vice versa. For example, during the period from 3Q 1998 to 2Q 2001 the output gap was positive and credit quality improved, but next period of negative output gap (i.e. Q3 2001 to Q1 2005) resulted in high credit standards. Interestingly, we can observe that in the period preceding the global financial crisis (i.e. Q3 2001 to Q1 2005) the probability of downgrading from A rating was almost zero despite the negative output gap. We can say that the market did not recognise the upcoming economic downturn. This situation was dramatically different in the next business cycle, when the output gap was

again negative (i.e. from 3Q 2008 to Q1 2014). We can see a substantial drop in output gap and the deterioration in credit standard at the same time. The probability to stay in category A was relatively low and the event of downgrade was more likely. The transition probability of downgrade to the default category (even from A category) was high. We can say that the market matured and learned from the previous periods when it underestimated the macroeconomic performance. In the latest period (i.e. from Q2 2014), we can observe a positive output gap and credit quality improved, possibly due to the more stringent banking regulation.

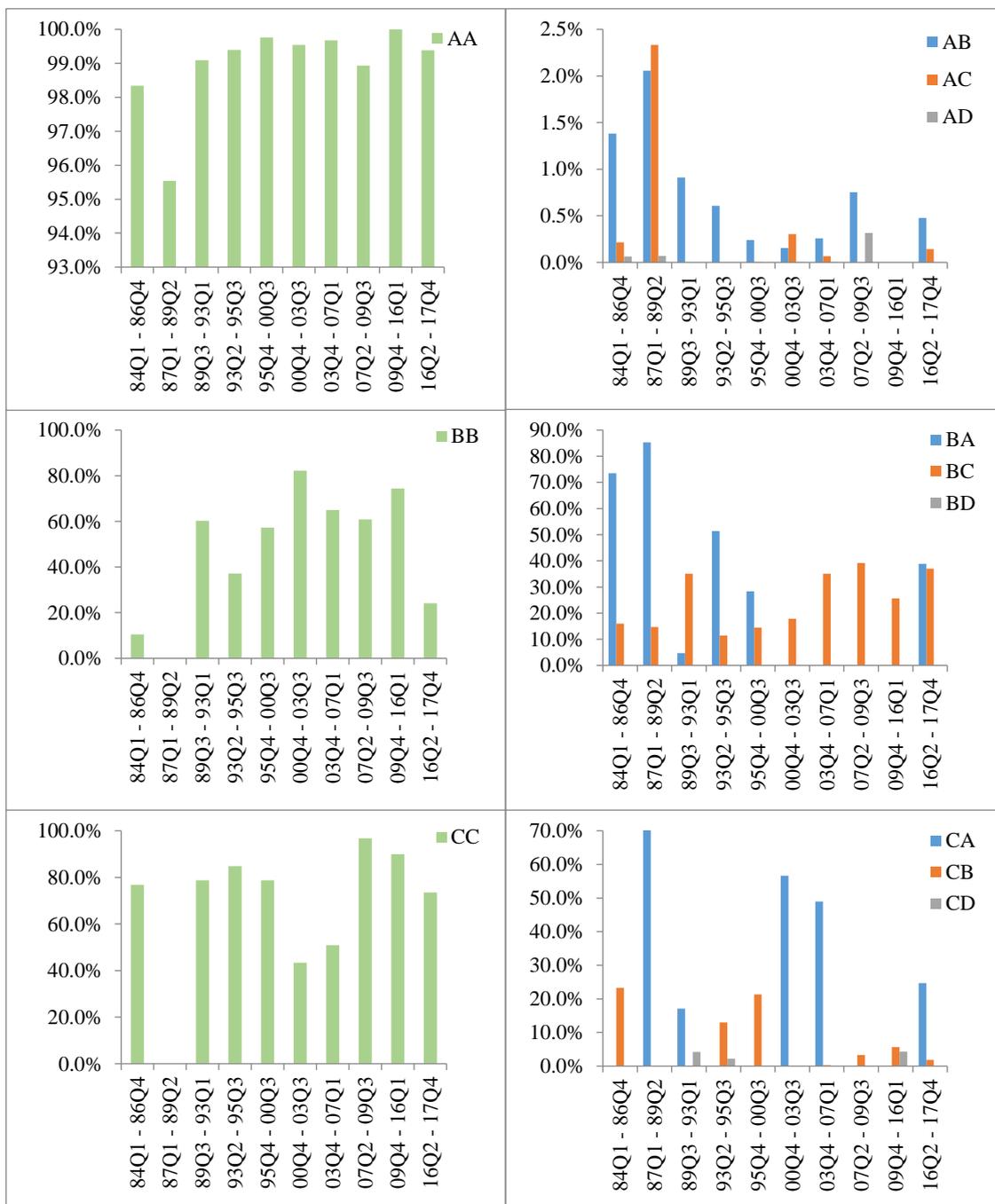
**Figure 4. Output gap results and transition probability**



Source: own prepared based on FRED data.

Figure 5 explains the same from the perspective of monetary policy. If we admit that the costs of borrowing play a role in appetite to borrow and consequently influence the loan repayment discipline then it makes sense to use the reference interest rate as a conditioning variable for Markov transition matrix.

**Figure 5. Fed Funds rates results and transition probability**



Source: own prepared based on FRED data

Figure 5 documents that it is complicated to assess the credit quality based on interest rate changes. In spite of this, it is possible point out few interesting observations. First, it seems that the stable interest rate evolution improves credit quality regardless of the level of interest rate. For example, the probability to stay in the same credit category was high during the periods from Q4 1995 to Q3 2003 and from Q4 2009 to Q1 2016. Both periods exhibited stable evolution of interest rates, but the level was substantially lower in later one. In terms of further evaluation, it is unambiguous that hawkish monetary policy results in higher credit quality or dovish policy deteriorates credit rates. We can see that dovish monetary policy from 1Q 1984 to 4Q 1986 resulted in credit rating deteriorations. The same is observable in the periods from 3Q 1989 to 1Q 1993 and 4Q 2000 to 3Q 2003. We can see similar causality

during the period from 2Q 2007 to 3Q 2009, which corresponds to the global financial crisis. We can thus identify evidence of credit quality worsening during times of interest rate decrease. Cheaper interest rates create an upward pressure on loans quantity. There are two possible effects. First, clients want to use the advantage of cheap borrowing. Second, the banks are searching for higher returns. As a consequence, they accept borrowers with a worse credit profile. In conjunction with remuneration based on commissions, risk taking is highly incentivised. Analysing hawkish monetary policy, the evidence is not clear. The period from Q1 1987 to 2Q 1989 is obviously very risky. The probability of downgrading and even default is relatively high. On the other hand, during the period from 2Q 1993 to 3Q 1995, we can see some improvements in terms of credit quality. For example, the probability to upgrade from category B to A or from C to B is quite high. From 4Q 2000 to 3Q 2003, the evidence is not clear. There is some potential to improve (i.e. from C to A category) but also a substantial part of loans downgraded (i.e. from B to C).

## CONCLUSION

The credit quality depends on various factors and conditions. We examined the loan quality check over the period from 1984-2017, in the economy of the United States of America using estimated Markov chain models expressed by transition probability matrices. Conditioning on macroeconomic performance represented by output gap and on monetary policy given by Fed Fund rate, we came with interesting implications applicable as an input to the credit rating models. Our main aim was to analyse what is the probability of a performing loan becoming non-performing and vice versa.

In case of macroeconomic performance and the stage of the business cycle, it can be concluded that the best credit quality performance is observed during periods when the output gap was stable, close to zero. Our results do not indicate that credit conditions were more favourable during periods of positive output gap and vice versa. We can see that negative output gap from Q3 2001 to Q1 2005 resulted in high quality standards. Markets did not see the risks before the global financial crisis. A different picture comes from the period from 3Q 2008 to Q1 2014, when the output gap was again negative, but credit quality deteriorated. This means that the market learned from the history and anticipated the possible troubles.

The results of the Fed Fund rate as a measure of monetary policy are more complex. First, we identified certain similarities with output gap in the positive credit quality corresponding to the stable evolution. In case of Fed Fund rates, we found that a stable evolution of interest rates results in better credit quality, which is independent of the level of the interest rate. In the event of dovish monetary policy, we observed worsening of credit quality related to the cheaper cost of borrowing, easier access to loans and higher appetite of banks to borrow. The last could be referred as a moral hazard phenomenon. In times of hawkish monetary policy, the evidence is not straightforward. In general, monetary policy should have an impact on credit standards. It would therefore be beneficial to verify more variables i.e., total credit injected into the economy measured by the total assets of the central bank, the great moderation periods or the credit multiplier.

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## APPENDIX A

Table A. Real estate loans - description of credit quality

	Performing loans	30-89 days past due	90 days or more past due	In nonaccrual status	Total charge- offs
<b>Starting period</b>	1984 Q1	1984 Q1	1984 Q1	1984 Q1	1984 Q1
<b>Ending period</b>	2017 Q4	2017 Q4	2017 Q4	2017 Q4	2017 Q4
<b>Frequency</b>	quarterly	quarterly	quarterly	quarterly	quarterly
<b>Num observations</b>	136	136	136	136	136
<b>Unit</b>	mil USD	mil USD	mil USD	mil USD	mil USD
<b>Mean</b>	2 579 703	35 215	25 580	50 647	3 988
<b>Median</b>	2 372 850	27 910	5 758	21 851	1 282
<b>Minimum</b>	399 449	7 571	3 130	4 991	132
<b>Maximum</b>	4 660 085	115 118	116 182	222 285	30 690
<b>Standard Error</b>	120 723	1 993	3 077	4 688	542
<b>Standard</b>					
<b>Deviation</b>	1 407 858	23 244	35 884	54 675	6 318
<b>Skewness</b>	0.00	1.59	1.52	1.70	2.38
<b>Kurtosis</b>	-1.49	2.10	0.82	1.92	4.97

Source: own prepared based on FDIC data

## APPENDIX B

Table B. Data description

	GDP	Interest rate
<b>Starting period</b>	01.01.1984	01.01.1984
<b>Ending period</b>	31.12.2017	01.02.2018
<b>Frequency</b>	quarterly	monthly
<b>Num</b>		
<b>observations</b>	136	410
<b>Unit</b>	bil USD	%
<b>Mean</b>	10820	3.86
<b>Median</b>	10490	4.11
<b>Minimum</b>	3913	0.07
<b>Maximum</b>	19754	11.64
<b>Standard Error</b>	399	0.15
<b>Standard</b>		
<b>Deviation</b>	4653	3.01
<b>Skewness</b>	0.21	0.27
<b>Kurtosis</b>	-1.24	-0.98

Source: own prepared based on FRED data

2.14-BG07-5829

## IN A SEARCH FOR THE INFLUENTIAL FACTORS OF INVESTORS' BEHAVIOUR

MOHAMMAD SAMI MOHAMMAD ALI<sup>1</sup>

### ABSTRACT

This research aims to explore the impact of interest rates, the M/BV ratio and the financial crisis on investors' behaviour, as captured by the stock market's performance, over the period December 1992 to December 2016. To accomplish the core aim of this study, a set of empirical techniques such as the ADF, Johansen co-integration and VECM tests are employed. Consequently, the findings showed that the used variables are found to be non-stationary at levels, while after converting them into the first difference they became stationary. Results from the Johansen and VECM tests revealed that investors' behaviour as measured by the buffet indicator is significantly impacted by the explanatory variables in the long run. However, when investors' behaviour was captured by the stock market index, no short or long correlation was detected. Additionally, the outcomes confirmed that investors' behaviour was adversely influenced by the financial crisis. Furthermore, the study concludes that investors of Jordan are risk-averse investors.

**Keywords:** Investors' behaviour, Buffet indicator, M/BV, WATDIR and WASDIR.

### INTRODUCTION

The economy of Jordan is a financially-based economy, highly reliant on the performance of the Amman Stock Exchange (ASE from here onwards). For instance, recent statistics revealed that the contribution of markets capitalisation in the country's GDP constituted 65% in 2016, compared with 83% by the end of 2013 (ASE, 2017). However, due to the impacts of deregulation and the series of global financial crises, the economy of Jordan witnessed structure fluctuations pre- and post-financial crisis, and metrics like interest rates and M/BV ratio lie at the heart of these fluctuations. Consequently, the average ratio of the ASE's M/BV increased from 1.12 in 2000 to 2.91 in 2006, before plunging to 1.2 by the end of 2016 (ASE, 2017). On the other hand, interest rates on time deposits accounts fell from 6.55% in 2000 to 2.88% in 2002, before climbing to 6.49% in 2006, and ultimately declining to 3% at the end of 2016. By the end of 2002, the weighted average saving deposits interest rate dropped from 1.8% to 0.99 in 2006, before decreasing to 0.6% by the end of 2016 (CBJ, 2017). However, although notable researchers (Ali, 2016; Al-Ali and Kassem 2013; Ojeaga and Odejimi, 2014) have appraised the importance of interest rates and the M/BV ratio in the process of decision making, the previous researchers have not measured the impact of movements in deposit interest rates, the M/BV ratio or market performance in the perception of Jordanian investors. Beyond that, studies including Mora (2010) proved that during the crisis period investors preferred to liquidate their securities to invest them in less risky investments such as treasury bills and bank deposits. Additionally, measuring the impact of interest rates and the M/BV ratio in the performance of stock markets and investors' behaviour is being studied intensively (e.g. Ali, 2014; Thang, 2009; Aurangzeb, 2012, Uddin and Alam, 2007; Al-Majali and Al-Assaf, 2014; El-Seoud, 2014). However, although many studies shed light on the influential factors of investors' behaviour, the empirical framework confirmed that there is no previous research which identifies the main determinants of investors' behaviour as proxied

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by the performance of the ASE. Additionally, although movements in variables like interest rates and the M/BV ratio have experienced dramatic fluctuations, there is a gap in literature regarding the impact of these financial metrics in the performance of the ASE. Therefore, the current research is mainly intended to identify the impacts of volatility in time and saving deposit interest rates and the average ratio of the ASE M/BV on the behaviour of Jordanian investors, over the period December 1992 to December 2016. The study will also investigate the impact of market performance in the behaviour of Jordanian investors. However, since the economy of Jordan, in common with other developing economies in the region, was adversely impacted by the 2008/11 financial crisis, this study also seeks to understand the impacts of this crisis in the performance of the ASE as a proxy for investors' behaviour.

## **EMPIRICAL REVIEW**

The current research is primarily intended to explore the potential determinants of investors' behaviour as captured by the performance of the ASE. Thus, to cover the theoretical and empirical foundation of this study, the following section presents a critical appraisal of the most recent studies concerning the influential factors of investors' behaviour and the market's performance. These studies are discussed and categorised below:

### **Stock market performance: related studies**

The review of literature has shown numerous studies concerning the influential factors of stock market performance. For example, a study by Zafar (2013) aimed at identifying the influencing factors in the performance of stock markets as measured by the market capitalisation/GDP. The results revealed a negative relationship between the real interest rate and the market performance. However, Khrawish, Siam and Jaradat (2010) found a significant-positive relationship between government prevailing interest rate and the market capitalisation, while the factor of government development was found to be negatively affecting the rate of market capitalisation. Similarly, Ologunde, Elumilade and Saolu (2006) confirmed a positive correlation between the market capitalisation rate and the prevailing interest rate. A study by Thang (2009) confirmed that in the long and short run the stock index of the Malaysian stock market is negatively related to both the interest and the exchange rates. Additionally, the study induced that when the interest rate is high investors prefer to liquidate their securities to deposit them into the banks, and vice versa. Consistent with this, Richard, Adekunle and Ojodu (2012) discovered a negative relationship between the rates of interest and the stock index of the Nigerian capital market. However, Al-Mukit (2012) showed a positive association between the exchange rate and the stock index of Dahaka stock market, while the weighted average saving deposit rate were found to be negatively associated with the stock index. Likewise, Aurangzeb (2012) revealed a negative correlation for the interest rates with the market's performance. Whereas a 1% increase in the deposit interest rates decreases the market's performance by 73%, the decrease in these rates stimulates investors to withdraw their money to invest them in the stock market. Ali (2016) argued that there is no long- or short-run causality running from the volatility in the M/BV ratio towards market liquidity as measured by the value traded and the turnover ratio. The study concluded that financial factors like M/BV ratio do not impact the behaviour of Jordanian investors.

### **Determinants of investors' behaviours**

Numerous studies have been performed to explain the potential determinants of investors' decisions and saving behaviour. For example, a study by Fares and Khamis (2011) found that factors including investor's ages, experience of using the internet, and the level of education significantly affect investors' trading behaviour. Mojgan and Ali (2011) revealed that variables like EPS and DPS play a central role in motivating Persian investors to invest in the

stock market. However, Nagy and Obenberger (1994) showed that variables like expected earnings and risk minimisation are found to be the most influential factors on securities investors. Azam and Kumar (2011) pointed out that factors like E/P, FDI and the real GDP are significantly impacting the stock index of the Karachi Stock Market as a proxy for investors' behaviour. Harsha and Kerav (2012) found that the variables of market capitalisation and past performance are the two most influential factors on investors' decisions in Vadodara and Ahmedabad, while variables like the fluctuations in markets' indices are the least effective determinants of investors' decisions. Acosta and Loza (2005) indicate that investment decisions in Argentina are significantly affected by exchange rates, inflation rates, trade liberalisation and the changes in the levels of aggregate demand, while, in the long-run these decisions are highly influenced by variables such as credit to private sector and external debt. A study by Yamin and Ali (2014) concluded that variables including M/BV ratio are significantly impacting the decisions of Amman Stock Exchange investors.

### **Financial crisis appraisal**

Al-Najjar et al. (2010) found that, although the economy of Jordan, as with other developing economies in the region, was adversely affected by this crisis, the lack of modern financial instruments in the ASE succeeded in mitigating the crisis's impact. Further results revealed that the listed financial sectors recorded a considerable decline due to the decline in the banking sector's index. Similarly, Al-Zyadat and Al-Kharabsheh (2013) revealed that the global crisis influenced the performance of ASE as monitored by stock prices and turnover ratio. Additionally, the higher interest rate resulted in decreasing stock prices and reduced lending activity by Jordanian commercial banks. Likewise, Neaime (2012) found that, since a majority of MENA region countries rely heavily on the FDI and exports to recover budget deficit, countries including Egypt, Jordan, Kuwait, Morocco and the United Arab Emirates were adversely impacted by this crisis, due to the dramatic decrease in the levels of FDI.

### **RESEARCH METHODOLOGY**

Quantitatively, the current research employed empirical techniques including the ADF, Johansen co-integration, VECM and Granger Causality Wald tests to measure the impact of WATDIR, WASDIR, and M/BV ratio in the behaviour of Jordanian investors, as captured by the performance of the Amman Stock Exchange. According to this study, the market performance indicator was typically gauged by utilising both the buffet indicator and the general stock index. However, to examine the impacts of the 2008-11 financial crisis in investors' behaviour, the study constructed a dummy variable that takes two values: the zero value assumes that the financial crisis does not impact the market performance, while the one value confirms that the performance of the ASE was impacted by the financial crisis. Moreover, to achieve the aim of this research, the study used a monthly time series data covering the period December 1992 to December 2016. The study's data were mainly obtained from the statistical bulletins of the Amman Stock Exchange, the Central Bank of Jordan, and the official websites of the Global Economy and the World Bank (ASE, 2017; CBJ, 2017; Global Economy, 2017; World Bank, 2017). However, before running the tests, the data were converted into the logarithm and standard deviation to measure impact of the volatility in the independent variables in the behaviour of the ASE's investors.

**RESEARCH HYPOTHESES**

To achieve the aim of this study, the following hypotheses were formulated:

**First main hypothesis**

*H<sub>1</sub>: There is a significant impact on the volatility in the WATDIR, WASDIR, M/BV and the ASEP in the behaviour of the ASE’s investors.*

**Second main hypothesis**

*H<sub>2</sub>: The RFC\_2008/11 was significantly impacted by the behaviour of ASE’s investors.*

**MODEL SPECIFICATION**

To test the above hypotheses, the following model was developed:

$$\text{Ln ASEP} = \beta_0 \pm \beta_1 \sigma\text{WATDIR} \pm \beta_2 \sigma\text{WASDIR} \pm \beta_3 \left( \sigma \frac{M}{BV} \% \right) \pm \beta_4 \text{ASEP} \pm \beta_5 \text{RFC\_2008/11} + \varepsilon_t \dots \dots \dots (1)$$

Where: the ASEP in the left side refers to the logarithm of the ASE's performance as measured by the buffet indicator and the general index of the ASE. Similarly, the ASEP on the right side refers to the market's performance. For instance, if the buffet indicator is employed on the left side, the general index will be used on the other side to examine whether it affects investors’ behaviour as measured by the market performance, and vice versa.  $\sigma\text{WATDIR}$  refers to the volatility in weighted average time deposit interest rates;  $\text{WASDIR}$  is the weighted average of saving deposit interest rates;  $\left( \sigma \frac{M}{BV} \% \right)$  indicate the market-to-book value ratio; and the RFC\_2008/11 refers to the recent financial crisis as a dummy.

**ESTIMATION PROCEDURE**

The current research employs time series data to achieve the core aims and objectives. Thus, to avoid spurious regression results, the study employed the ADF test to examine the following model:

$$\Delta Y_t = \delta_0 + \delta_1 + \delta_2 Y_{t-1} + \sum_{i=1}^p \alpha \Delta Y_{t-i} + \varepsilon_t \dots \dots \dots (2)$$

Where:  $\delta_0, \delta_1, \delta_2$  and  $\alpha$  are the parameters to be estimated and  $\varepsilon_t$  relates to the disturbance term. Thereafter, the study ran the Johansen co-integration test. Consequently, the results found a statistical integration between the variables I (1). Therefore, since the variables are integrated of the same order, this implies the existence of an adjustment mechanism. This adjustment was examined by running the single equation of the restricted vector error correction model “VECM”. The following ECM follows the order of specification of the first model:

$$\begin{aligned} \Delta \text{Ln ASEP}_{it} = & \beta_0 \pm \sum_{i=1}^{k-1} \beta_{1i} \Delta \text{ASEP}_{t-i} \pm \sum_{i=1}^{k-1} \beta_{2i} \Delta \sigma.WATDIR_{t-i} \pm \\ & \sum_{i=1}^{k-1} \beta_{3i} \Delta \sigma.WASDIR_{t-i} \pm \sum_{i=1}^{k-1} \beta_{4i} \Delta \left( \sigma \frac{M}{BV} \% \right)_{t-i} \pm \sum_{i=1}^{k-1} \beta_{5i} \Delta \text{ASEP}_{t-1} \pm \\ & \sum_{i=1}^{k-1} \beta_{6i} \Delta \text{RFC\_2008/11}_{t-1} \pm \sum_{i=1}^{k-1} \gamma_1 \sigma.WATDIR_{t-i} \pm \sum_{i=1}^{k-1} \gamma_2 \sigma.WASDIR_{t-i} \pm \\ & \sum_{i=1}^{k-1} \gamma_3 \left( \sigma \frac{M}{BV} \% \right)_{t-i} \pm \sum_{i=1}^{k-1} \gamma_4 \text{ASEP}_{t-1} \pm \sum_{i=1}^{k-1} \gamma_5 \text{RFC\_2008/11}_{t-1} \pm \psi_i \varepsilon_{t-1} \pm \\ & \mu_t \dots \dots \dots (3) \end{aligned}$$

Where:  $\Delta \text{Ln ASEP}_{it}$  is the first difference operator of the dependent variable. This variable relates to the Amman Stock Exchange performance.  $\beta_i: i= 1, \dots, 6$  are the parameters to be estimated and indicate the coefficients of the short-run dynamics.  $\gamma_i: i=1, \dots, 5$ , parameters refer to the long-run multipliers.  $\Psi_i \varepsilon_{t-1}$  is the first lagged period of the error correction term and  $\mu_t$  refers to the white noise error term with the usual properties. To examine whether the

set of independent variables cause Granger in the performance of the ASE in the long run the above model assumes that the coefficient of error term equals zero. Thus, this null hypothesis is tested against the alternative one, which assumes that the error term  $\neq 0$ .

## VARIABLES' DESCRIPTION AND MEASUREMENTS

### First: explanatory variables

#### *The ASE's M/BV ratio*

This ratio refers to the average ratio of the ASE's market-to-book value. This ratio was calculated by Al-Dahrawi (2016) as shown below:

$$\text{The average ratio of the ASE's M/BV} = \frac{\text{ASE's market value}}{\text{ASE's book value}}$$

#### *Deposit interest rates*

These rates refer to the weighted average of interest rates which are paid by Jordanian commercial banks for customers' time and saving deposits.

#### *The recent financial crisis*

This research constructs a dummy variable to measure the impact of the 2008-11 financial crisis on investors' behaviour. This dummy takes two values, 'zero and one'. The 0 value means that the financial crisis does not impact the behaviour of Jordanian investors. However, the one value means that this crisis was significantly impacting investors' behaviour.

### Second: dependent variables

#### *Stock markets' performance*

To measure the performance of the Amman Stock Exchange two main measures are employed as described below:

#### *Buffet indicator*

This is a long-run valuation indicator that is used to measure the stock market's performance, based on market size. This indicator is calculated as shown below:

$$\text{Buffet Indicator} = \frac{\text{Stock Market Cap}}{\text{GDP}} * 100$$

#### *The ASE general index*

This is considered as one of the three important indices in the ASE, using 1000 points as a base value. This index is supplemented by sub-indices for the main four sectors: the banking and finance sector, insurance, services, and the industrial sector. The index is calculated by using the market capitalisation of the free float shares of companies. The index consists of 100 listed traded companies. These companies are selected based on the number of traded days and market capitalisation.

## RESULTS AND CONCLUSION

This research employs monthly time series data to determine the most influential factors which are impacting the behaviour of Jordanian investors as captured by the market's performance. Thus, to avoid spurious regression results; the study employed the ADF test to check for stationarity. The results showed that all the variables are found to have unit roots when they are tested at levels. However, after converting them into the first difference, the trends were eliminated. Therefore, the study applied the Johansen test, and the results confirmed that there is a statistical integration among the variables of interest. The findings of the error correction model showed that, in the long run, the performance of the ASE as

measured by the general index is not found as Granger caused by the movements in M/BV ratio, the rates of interest and the buffet indicator. Similarly, investors' behaviour as measured by the stock index was not impacted by the recent financial crisis. Additionally, findings from the Wald $\chi^2$  Granger test confirmed that the set of independent variables do not cause Granger on investors' behaviour as measured by the stock market index in the short run. On the other hand, when the performance of the ASE was captured by using the market cap relative to the GDP, results from ECM validated the outcomes of the Johansen test. Therefore, the findings proved that there are long-run causalities running from the M/BV ratio, interest rates and the stock index towards investors' behaviour. The results also showed that the recent financial crisis adversely affected the performance of the ASE as measured by the buffet indicator. However, results from the Wald test showed that there are no short-run correlations between the variables. Furthermore, post-estimation tests including the LM proved that there is no serial correlation in the residual. For the results of the ADF, Johansen, VECM, Wald and the LM tests see tables 1 to 9 in the Appendix.

## CONCLUSION

This research was designed to determine the most influential factors of investors' behaviour as captured by the performance of the ASE, over the period December 1992 to December 2016. Thus, after checking for data stationarity, the results showed that when the first difference was added all the variables became stationary of the same order. Thereafter, the study applied the Johansen co-integration test, before running the VECM test. The findings revealed that there is no long- or short-run causality running from the volatility in interest rates, M/BV ratio or the buffet indicator towards investors' behaviour as captured by the stock index. Similarly, the recent financial crisis was not affected the general index of the ASE. The results seem to be consistent with Ali (2016) as they proved that there is no long- or short-run causality running from the M/BV ratio towards the liquidity of the ASE. However, studies (including Yamin and Ali, 2014; Shaban and Al-Zubi, 2014) revealed that the decisions of the ASE are affected by variables like the M/BV ratio. Thang (2009) found a negative short- and long-run integration between interest rates and the stock market indices. Therefore, the study concludes that there may be some other factors affecting investors' behaviour as proxied by the stock index. For instance, Azam and Kumar (2011) documented that factors like E/P, FDI and the real GDP are significantly impacting the stock index of the Karachi stock market as a proxy for investors' behaviour. By contrast, the study shows that in the long run the behaviour of the ASE's investors as measured by the buffet indicator is statistically impacted by the movements in the M/BV ratio, WATDIR, WASDIR and the stock index. These results are consistent with Zafar (2013) as he finds a negative correlation between interest rates and the market performance as measured by the rate of market capitalisation. The results of the current study also documented that the recent financial crisis negatively impacted the performance of the ASE, in agreement with Al-Najjar et al. (2010) and Al-Zyadat and Al-Kharabsheh (2013). Moreover, the study concludes that variables like M/BV, WATDIR, WASDIR and the stock index are commonly used by Jordanian investors to make their investment decisions. However, since the decrease in the M/BV ratio and the WATDIR is found to stimulate investors to invest in the stock market, the study induced that investors of Jordan can be classified as rational or risk-averse investors (see Thang, 2009). Furthermore, since the recent crisis negatively impacted investors' behaviour, the study concludes that during the crisis period investors became more risk-averse as they liquidated their financial securities to invest them in less risky investment opportunities such as bank deposits or bonds. This result is consistent with Mora (2010) who found that during the crisis period investors preferred to liquidate their securities to employ them in less risky investments, such as treasury bills and bank deposits.

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## APPENDIX

### Table 1. ADF's results

The following table demonstrates that all the time series variables became stationary, only after adding the first difference.

Variable	Level 5%		P-Value	1 <sup>st</sup> Diff	Remark	H <sub>0</sub>
Cap/GDP	-3.429	-4.126	0.0058	1	I (I)	Rejected
G.Index	-3.429	-3.697	0.0226	1	I (I)	Rejected
M/BV	-3.429	-3.443	0.0459	1	I (I)	Rejected
WATDIR	-3.429	-3.643	0.0264	1	I (I)	Rejected
WASDIR	-3.429	-4.087	0.0066	1	I (I)	Rejected
RFC_2008/11	-3.429	-6.875	0.000	1	I (I)	Rejected

Note: \*\*\* indicates that the time series variables are significant at 5 per cent level of significance.

### Table 2. Johansen co-integration results

The results revealed a long-run integration between investors' behaviour as measured by the stock index along with the set of independent variables.

**VEC-rank G.Index, M/BV ratio, WATDIR. WASDIR. Cap/GDP, RFC\_2008/11, trend(Constant) Lags (3) max  
Johansen tests for Co-integration**

Trend: Constant				No. of Obs. = 285
Sample: 1993m4-2016m12				Lags= 3
Maximum				
Rank	Eigen Value	H <sub>0</sub>	Trace Statistics	1% Critical Value
0	.	R=0	106.1	103.1
1	0.1166	R ≤ 1	70.78*	76.07
2	0.0965	R ≤ 2	41.85	54.46
3	0.0782	R ≤ 3	18.63	35.65
4	0.0319	R ≤ 4	9.371	20.04
5	0.0285	R ≤ 5	1.104	6.65
6	0.0038	.	.	.

### Table 3. Vector error correction model (VECM)

The results confirmed that there is no long-run integration between the set of independent variables along with the stock market's index.

	Coef.	Std. Error	Z	P > /Z/	99% Cnof.	Interval
D_G.Index						
_Ce1						
L1	0.0068	0.0017	3.87	0.000	0.0022	0.0113
G. Index						
LD.	0.9939	0.2328	4.27	0.000	0.3943	1.5936
L2D.	-0.0417	0.2326	-0.18	0.858	-0.6408	0.5574
M/BV						
LD.	-0.0070	0.1843	-0.04	0.970	-0.4819	0.4679
L2D.	-0.0157	0.1846	-0.09	0.932	-0.4914	0.4598
WATDIR						
LD.	-0.0019	0.0042	-0.45	0.654	-0.0129	0.0091

L2D.	-0.0020	0.0038	-0.53	0.594	-0.0119	0.0078
<b>WASDIR</b>						
LD.	0.0011	0.0096	0.12	0.906	-0.0236	0.0259
L2D.	-0.0002	0.0090	-0.02	0.980	-0.0235	0.0231
<b>Cap/GDP</b>						
LD.	-0.0398	0.0594	-0.67	0.503	-0.1930	0.1133
L2D.	0.0125	0.0595	0.21	0.832	-0.1407	0.1659
<b>RFC_2008/11</b>						
LD.	-0.0010	0.0019	-0.52	0.604	-0.0061	0.0041
L2D.	-0.0009	0.0018	-0.51	0.607	-0.0055	0.0037
Cons_	0.0002	0.0003	0.87	0.382	-0.0005	0.0010

**Table 4. Wald results**

Results from the Wald test proved that there is no short-run causality running from the independent variables towards investors' behaviour.

Variable	Chi2	Prob>chi2
M/BV	0.11	0.948
WATDIR	1.43	0.488
WASDIR	0.02	0.991
Cap/GDP	1.50	0.827
RFC_2008/11	0.51	0.774

**Table 5. LM test**

The results of Lagrange-Multiplier Test showed that the examined variables did not present any autocorrelation at lag one or two.

Lag	Chi2	Df	Prob>chi2
1	36.461	36	0.4472
2	49.285	36	0.0690

**Table 6. Johansen co-integration results**

The results revealed a long-run integration between investors' behaviour as measured by the buffet indicator along with the set of independent variables.

**VEC-rank Buffet indicator, M/BV ratio, WATDIR, WASDIR, G.Index, RFC\_2008/11, trend(Constant) Lags (3) max**  
**Johansen tests for Co-integration**

Trend: Constant				No. of Obs. = 285
Sample: 1993m4-2016m12				Lags= 3
Maximum				
Rank	Eigen Value	H <sub>0</sub>	Trace Statistics	1% Critical Value
0	.	R=0	106.1	103.1
1	0.1166	R ≤ 1	70.78*	76.07
2	0.0965	R ≤ 2	41.85	54.46
3	0.0782	R ≤ 3	18.63	35.65
4	0.0319	R ≤ 4	9.371	20.04
5	0.0285	R ≤ 5	1.104	6.65
6	0.0038	.	.	.

**Table 7. Vector error correction model (VECM)**

Since the error term is negative and significant, the results validated results from Johansen test. Meaning, that there are long-run causalities running from the independent variables towards investors' behaviour as measured by the buffet indicator.

	Coef.	Std. Error	Z	P > /Z/	99% Cnof.	Interval
<b>D_Cap/GDP</b>						
<b>_Ce1</b>						
L1	-0.00324	0.00064	-5.00	0.000	-0.049	-0.0157
<b>Cap/GDP</b>						
LD.	0.7725	0.1899	4.07	0.000	0.283	1.261
L2D.	0.0242	0.190	0.13	0.898	-0.465	0.514
<b>M/BV</b>						
LD.	-0.0711	0.5888	-0.12	0.904	-1.587	1.445
L2D.	-0.0980	0.5896	-0.17	0.868	-1.616	1.420
<b>WATDIR</b>						
LD.	-0.0081	0.0136	-0.60	0.551	-0.0434	0.027
L2D.	-0.0071	0.0122	-0.58	0.563	-0.0387	0.024
<b>WASDIR</b>						
LD.	0.0078	0.0307	0.25	0.800	-0.071	0.087
L2D.	0.0072	0.0289	0.25	0.802	-0.067	0.081
<b>G.Index</b>						
LD.	0.2235	0.7434	0.30	0.764	-1.691	2.138
L2D.	-0.0200	0.7428	-0.03	0.978	-1.933	1.893
<b>RFC_2008/11</b>						
LD.	-0.0033	0.0063	-0.52	0.603	-0.0197	0.013
L2D.	-0.0029	0.0057	-0.51	0.613	-0.0177	0.011
Cons_	0.0004	0.0009	0.46	0.643	-0.0020	0.002

**Table 8. Wald results**

Results from the Wald test proved that there is no short-run causality running from the independent variables towards investors' behaviour.

Variable	Chi2	Prob>chi2
M/BV	0.57	0.750
WATDIR	2.06	0.357
WASDIR	0.34	0.845
G.Index	1.76	0.881
RFC_2008/11	1.24	0.872

**Table 9. LM results**

This table demonstrates results from Lagrange-Multiplier Test, which is applied to examine the status of autocorrelation at lag among the examined variables. Consequently, the results did not present any autocorrelation in the residual, neither at lag one nor at lag number two.

Lag	Chi2	Df	Prob>chi2
1	36.46	36	0.447
2	49.28	36	0.069

3.18.BG48-5910

## ACHIEVING BUSINESS AND ITS ALIGNMENT IN THE DIGITAL SERVICE REDESIGN: A STUDY OF THE UK E-GOVERNMENT

LAMYA ALNASSAR<sup>1</sup>

### ABSTRACT

Prior research has shown that there are a variety of ways in which business-IT alignment (BIA) can help an organisation. BIA can increase the UK's e-government maturity level and can improve the quality of e-government and the service redesign process, and ensure the establishment of an integrated, coherent, user-centred, and agile digital culture. However, business-IT alignment is challenging when there are many organisations (central and local government organisations) involved in the process. This research aims to increase our understanding of the 'process of aligning', both vertically (between central and local government), and horizontally (across government agencies). Analysis of the data suggests that *decentralisation* is a barrier, whereas *communication* is a significant enabling factor. This study not only provides 'theory for explanation', making it scientifically useful, but also offers 'theory for design', for practical uses. It links alignment and e-government together, a connection which is not fully explored in the literature.

**Keywords:** Business-IT alignment, E-government, UK service re-design, Communication, Grounded theory

### INTRODUCTION

Over time, government agencies are becoming more reliant on IT for their e-government initiatives and services redesign. The literature has recognised that alignment facilitates a strategic and more effective use of IT (Karpovsky and Galliers, 2015). The UK is continuously increasing its IT investments and re-shaping how it uses and buys technology (Bracken, 2015). Alignment can help maximise the return on those IT investments and ensure that those IT arrangements fit with the business strategy, goals, and needs of the services redesign.

This study aims to understand how alignment between business and IT strategies is being managed in the digital redesign of UK public services. The rationale behind this research lies in the belief that increasing business-IT alignment will enable the UK to reach the highest e-government maturity level which, according to the European Digital Capability EDC Framework, is to have a strong, agile, user-centred, innovative and responsive digital culture (Great Britain, Cabinet Office, 2013). This study argues that by illustrating and drawing on the importance of the factors influencing business-IT alignment, the UK government will be in a better position to increase their level of business-IT alignment.

#### Aim

To understand how business-IT alignment is being managed to facilitate the digital redesign of UK public services.

#### Objectives

1. To achieve a critical understanding of the literature on e-government and business-IT alignment, particularly e-government development and service redesign in the UK.

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2. To gain insights into the practice of alignment in the UK departmental and local government to support service redesign of public services.
3. To contribute to the academic literature on e-government services redesign and business-IT alignment in the public sector.

## LITERATURE REVIEW

### The history of e-government in the UK

During the 1990s, the U.S., Britain, Canada and Australia were amongst the first to adopt a basic informational web presence and to lead the development of e-government phenomena (Lee, Tan and Trimi, 2005). The UK e-government agenda was introduced in the *Modernising Government* White Paper in 1999. The central objective of this programme was “modernisation for a purpose, to make life better for people and businesses” (Great Britain, Prime Minister’s Office and Cabinet Office, 1999, p. 7). Essentially, the programme focused on five commitments. These were policy-making for long-term change, citizen-centric responsive public services, high quality and efficient services, utilising new technologies to create an “information age government”, and valuing rather than denigrating public services (Great Britain, Prime Minister’s Office and Cabinet Office, 1999, p. 7).

In March 2000, the Prime Minister set the target of delivering all public services online by December 2005 (Great Britain, Prime Minister’s Office and Cabinet Office, 1999). However, this target was not achieved entirely (Shareef, Jahankhani and Dastbaz, 2012), and a new target was set for all government dealings to be deliverable electronically by 2008. According to Margetts (2006), “by 2005 almost all government departments and agencies and local governments have a website” (p. 1). From the early stages, they considered the fact that some citizens and small firms may not have the advantage of accessing the web. Their solution was to enable them to communicate with public agencies through other means, and by providing cheap access to PCs, and connecting public facilities, such as libraries, to the web.

According to the *Government on the Web II* (2001-2002) report, the main force for the adoption of e-government was the rising demand from citizens and enterprises to be able to access government information, communicate and transact with the government electronically (NAO, 2002). Matching the success of the private sector was another motivating factor force and placed pressure on the UK government to modernise processes, cut spending, and increase efficiency (NAO, 2002).

In March 2004, the UK e-government successfully launched their official portal DirectGov (a replacement of the previous portal “UK online”) (Shareef, Jahankhani and Dastbaz, 2012). DirectGov was the responsibility of the Cabinet Office Electronic Government Unit (eGU), which was a unit dedicated to supporting administrative changes of government and allowing electronic access to government services and information (Galindo, 2006). In addition, a ‘transformational government’ strategy was created in 2006, which focused on certain themes: customer-centric shared services and professionalism (Great Britain, HM Government, 2006).

In April 2006, a request was made by the Cabinet Office to move content to either the DirectGov website developed for citizens, or to the Business Link website developed for businesses. The considerable benefits of DirectGov were obvious. It facilitated access to, and delivery of, services and information in a faster and more effective way (Norton, 2008). Irani, Al-Sebie and Elliman (2006) argued that more transactions needed to be carried out online to gain the benefits of cost saving.

In October 2012, with the arrival of a new government in Westminster, the UK replaced DirectGov and Business Link portals with GOV.UK, which was designed and built

by the new Government Digital Service (GDS) (Great Britain, Crown, n.d.). GDS is not concerned with website design only, but also works with other government agencies in order to design public services that are: “digital by default, simpler, clearer and faster to use” (Great Britain, Crown, n.d.). It was stated in the Digital Strategy of October 2012 that the aim was to move all government departments and public agencies content to the GOV.UK website by March 2014 (Great Britain, Cabinet Office, 2015). However, resourcing difficulties resulted in a delay and this was not achieved until December. “The result is that almost all government information is now available in a single trusted place, making it clearer, simpler and faster for people to deal with government” (Great Britain, Cabinet Office, 2015).

### **Business-IT alignment**

The concept of business-IT alignment (BIA) has been a well-known notion since the late 1970s (Luftman, 2000). Luftman (2000) defined BIA as “applying information technology (IT) in an appropriate and timely way, in harmony with business strategies, goals and needs” (p. 3). Another definition is “the degree of fit and integration between business strategy, IS strategy, business infrastructure, and IS infrastructure” (Henderson and Venkatraman, 1999, cited in Gotze and Jensen-Waud, 2013, p. 300). Campbell et al. (2005) defined alignment based on answers from focus group participants: “alignment is the business and IT working together to reach a common goal” (p. 662). Other terms or synonyms of business-IT alignment found in the literature include: harmony, linkage, fusion, and integration. It should be noted that business-IT alignment and IT-business alignment are considered the same, because the objective is to ensure that there is a harmony or linkage between the two (Luftman, 2000).

Henderson and Venkatraman (1993) identified a lack of frameworks to help with understanding the potential of IT in supporting business strategies or creating new business strategies. The authors therefore developed a model, named the strategic alignment model (SAM), consisting of four domains. Those domains are:

- Business strategy
- Information technology strategy
- Organisational infrastructure and processes, and
- Information technology infrastructure and processes.

The model also includes two strategic management characteristics: ‘strategic fit’ (representing the interrelationship between the internal and external components), and ‘functional integration’ (representing the integration between the business and functional domains) (Henderson and Venkatraman, 1993).

There are a number of researchers who have extended this concept and built new frameworks. However, Luftman (2000) stated that it is still not clear how to achieve and assess alignment. Therefore, the author has proposed a framework for assessing the maturity of business-IT alignment. It includes six criteria, which are: communication, competency/value measurement, governance, partnership, scope and architecture, and skills. He has also used the alignment enablers as elements for the evaluation or assessment of each criterion (Luftman, 2000). For example, communication consists of six scaling criteria; the understanding of business by IT, understanding of IT by business, organisational learning, style and ease of access, leveraging intellectual assets, and IT-business liaison staff (Luftman, 2003).

### **Alignment enablers and inhibitors**

Once an organisation’s alignment level has been identified, it is possible for there to be a focus on increasing the enablers and decreasing the inhibitors, and on maintaining harmony between business and IT (Charoensuk, Wongsurawat and Khang, 2014). Luftman (2000)

listed the alignment enablers, starting from the most important. These included senior executive support for IT, IT involved in strategy development, IT understanding of the business, business-IT partnership, well-prioritised IT projects, and IT demonstrating leadership. Charoensuk, Wongsurawat and Khang (2014) found that one of the most significant enablers is shared domain knowledge (SDK), which occurs when the business and IT units are able to understand and learn from each other. The authors added that communication facilitates SDK. Reich and Benbasa (2000) supported this view concluding that SDK is the only factor that produces long-term alignment. Weiss and Anderson (2004) identified the antecedents and found that there are four common themes when investigating organisations with a good level of business-IT alignment; “clear direction, commitment, communication, and cross-functional integration” (p. 7).

## RESEARCH METHODOLOGY

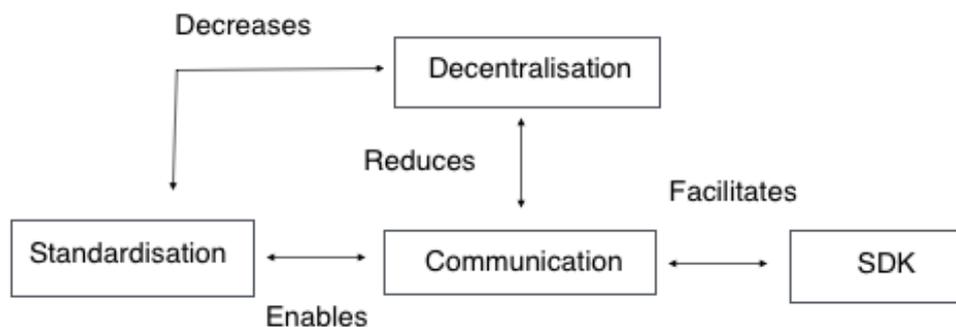
This study provides a holistic view of ‘alignment as a process’ rather than ‘alignment as a state’. It also provides ‘theory for explanation’, as it aims to increase our understanding of the ‘process of aligning’, both vertically (between central and local government), and horizontally (across government agencies), challenges and difficulties faced in aligning, and how it affects alignment in public services redesign. More specifically - and to expand on the literature - it moves beyond ‘alignment in theory’ and explores and explains ‘alignment in practice’. The findings of this research reflect the practical reality and experiences of practitioners involved in the day to day activities of the UK public services redesign. It also offers ‘theory for design’, as it prescribes how e-government practitioners can enhance the level of business-IT alignment and overcome issues of misalignment.

A qualitative research approach and grounded theory method were used in the research. Semi-structured interviews were carried out with service managers, policy makers, digital leaders, and business and IT senior managers from government departments, such as the Cabinet Office, Government Digital Service (GDS), and local councils, including Oxfordshire County and its districts. Local authorities are part of the service redesign process of public services and deliver most of the UK’s public services. It is therefore important to understand how alignment is being managed vertically from local to central government, and horizontally across local authorities. It is also important to gain an understanding of bodies supporting digital redesign (such as The Society of Information Technology Management (SOCITM), Nesta - The innovation foundation, LocalGov Digital, and Local Digital Coalition (LDC)).

Strauss and Corbin’s (1990) grounded theory method was used to produce theory grounded in the data, and, most importantly, to ensure that the data was systematically collected and analysed. The main aim of Strauss and Corbin’s (1990) coding stages is to distinguish a core or central category. Communication was therefore identified and treated as a core factor because it was found that all the major factors of the research are connected to it. This paper provides a theoretical model presenting the interrelation of key factors of alignment in UK services redesign. These are: standardisation, Shared Domain Knowledge (SDK) and decentralisation – in addition to the core factor, communication (Figure 1).

## FINDINGS AND DISCUSSIONS

The data collected identified a number of factors which have been referenced in previous studies, as well as new findings. These factors influence alignment and are discussed in this study as ‘enablers’ or ‘inhibitors’ of alignment (see Figure 1). As mentioned previously, communication was identified as a core factor, and therefore this section will focus on the level of vertical and horizontal communication, and the interrelation of communication with other key factors.

**Figure 1. Interrelation between key factors of alignment in UK services redesign**

### Level of vertical and horizontal communication between business and IT

The empirical findings have continuously shown communication to be an alignment enabler (Luftman, 2000), which specifically facilitates social alignment, as shown by Reich and Benbasat (2000). Additionally, this was expressed by one of the interviewees: “I admit that one of the reasons why we’re not very well aligned is because we don’t communicate”. It was found from the data collected that there is less communication between central and local government than between local authorities or between central government departments. According to one of the interviewees, “there should be a clearer steer from central government by sharing what’s best practice out there”. On the contrary, there are local authorities that prefer to operate autonomously without communicating with central government or receiving any central government steering. This paper therefore argues that decentralisation is one of the main reasons for the lack of communication between local and central government.

There are local authorities which recognise the importance of communicating with central government and keeping abreast of the direction of travel in central government more than others. Such local authorities maintain some external networking forums. Unlike some other authorities, when developing a programme or a strategy, they will communicate with people in central government. It was found that those communications and discussions take place via bi-lateral contacts in GDS, and through conference circuits.

Additionally, they explained that organisations’ forums were used to share interesting information which may have been heard from another local or central organisation and is relevant to their organisation. In most cases, these involve aspects and consequences that affect more than one person, division or team within the organisation. They illustrated that in those situations the process can often begin with informal communications, rather than formal communications such as meetings or project management boards.

Data collected has shown that local government’s communication with central government usually happens through the Local Government Association (LGA), who is generally considered to be the chief spokesperson for local government. As also stated by the LGA (2018), “we are the national voice of local government, working with councils to support, promote and improve local government”. However, the value of this was questioned

by one of the interviewees from a local council, who stated that their influence should not be overestimated.

Additionally, local government's communication with central government can be established through communication forums. However, these are not always effective. As explained by one interviewee, often when a new piece of legislation comes in (e.g., The Homeless Reduction Act), and in other situations where central government passes significant extra responsibilities and services onto local authorities, sufficient communication is rarely established beforehand. A major disadvantage stemming from this is that there is not usually adequate funding for the additional responsibilities. In this respect, the lack of communication between central and local government only serves to create further problems in an already challenging environment, and therefore makes alignment more difficult.

Nonetheless, the data collected has shown that central government deals with an array of issues. As a result, communication with local authorities may not be one of their priorities. There are around 418 local councils in the UK, meaning that communication with all of them is a difficult task. Another explanation for the lack of communication is that local government often operates differently from central government. This means that there is a lack of understanding and shared domain knowledge (SDK) between central and local government. According to an interviewee, "it's been very difficult to gain an understanding I suppose, perhaps from the cabinet or whatever group it is that needs to approve a project". The interviewee explained that often business cases are complicated, and therefore cannot be straightforwardly communicated with higher-level organisations. In this respect, it can be said that IT and the businesses from central and local government find it difficult to attain an understanding and SDK, which is empirically proven to be crucial for long-term social alignment (Reich and Benbasat, 2000). Moreover, this study also finds that communication between business and IT from central and local government will, over time, enhance understanding and SDK, which is also proven empirically by Charoensuk, Wongsurawat and Khang (2014).

### **Lack of communication between the business and IT in local government**

The data collected has shown a lack of communication between people involved in local government business and IT departments. As mentioned by one of respondents from the local government business department, "communication is key and that's partly where we're weak". This weakness mainly stems from the failure to communicate messages to the right people or individual team members. Moreover, the right people may also not be involved in conversations or meetings. As pointed out by an interviewee from the local government IT department, "either the cascade doesn't work, or the actual forums are not working in keeping each other up to date".

### **Relationships between key alignment concepts or factors**

#### ***Communication and standardisation***

This section will seek to explain the relationships between different concepts, as shown in Figure 1. Standardisation is considered in this study as one of the enablers of vertical and horizontal alignment in service redesign. The aspects of standardisation which are believed to enable alignment include: adopting a common approach to services redesign, services redesign standards, and common open data standards.

An example of standardisation is the Digital by Default standard set by the Government Digital Service (GDS). It consists of 18 criteria to assess services before going live on GOV.UK website ([gov.uk/service-manual/digital-by-default-26-points](http://gov.uk/service-manual/digital-by-default-26-points)) (Great Britain, National Archives, 2018a). However, as stated by an interviewee from GDS, these are standards that "can be applied by an authority but there is no political power that says it must

be”. There are also standards developed for local government by LocalGov Digital. Those standards are based on the principle that local agencies should be ‘open by default and digital by design’ (LocalGov Digital, 2016). A draft of the standards is available on their website (<http://localgovdigital.info>). Nonetheless, it is also found that many local councils are providing local services without adopting those standards, or any other clear common service redesign standards.

The data collected has shown that participants from IT are aware of the importance of standardisation more than participants from business. It also shows that there is more motivation and interest in standardisation in local government than in central government. This paper therefore suggests that communication between government agencies (centrally and locally) will increase awareness of the importance of standardisation, and the exchange of knowledge of standardisation (e.g., service redesign standards, and common platform or solutions). The level of standardisation will be higher when IT communicates their ideas for standardisation (e.g., by the use of story-telling and real-life examples) and demonstrates its benefits to the business over the use and adoption of a niche product or a siloed solution. Therefore, communication will enable a higher level of standardisation vertically and horizontally. Nevertheless, standardisation will also facilitate rapid and easier communication, flow and exchange of information and ideas across local authorities, and between central and local government.

#### ***Communication and shared domain knowledge (SDK) between business and IT***

SDK has also been found to be a significant factor influencing alignment in UK service redesign. Communication is widely recognised in the literature as a facilitator of SDK, identified by authors such as Reich and Benbasat (2000) and Campbell, Kay and Avison (2005) as the only factor that produces long-term alignment. This study follows Reich and Benbasat’s (2000) definition of SDK as “the ability of IT and business executives, at a deep level, to understand and be able to participate in the others' key processes and to respect each other's unique contribution and challenges” (p. 86).

The findings of this study have revealed that the failure to communicate could result from the lack of deep understanding between business and IT, which this study considers to be an element of SDK, and results in a lower level of alignment between the business and IT. This suggests that a deep understanding is required first, in order to communicate. This can be contrasted to the literature which argues that communication is a prerequisite or enabler of SDK and not also the other way around (Reich and Benbasat, 2000). This paper believes that a low level of SDK will make communication (between the business and IT horizontally and vertically) difficult: it is perceived that if there is no shared knowledge, then there is little or nothing to communicate about.

Nevertheless, according to one of the interviewees from the business, the business can establish a better understanding of IT when having an operational-based communication rather than a technical-based communication. A shared deep understanding with IT will not be established if the communication does not use a common language with the right people in the organisation. This is therefore in line with the literature that shows that communication comes before SDK (Reich and Benbasat, 2000). This paper suggests that communication between business and IT from central and local government will, over time, enhance understanding, and therefore increase SDK between the business and IT in service redesign. In addition, communication using an operational rather than a technical based language will help to maintain the interest of the business (or communication by translating and using a language that the business can understand) and will therefore create more SDK.

#### ***Communication / standardisation and decentralisation***

There are many benefits to horizontal and vertical standardisation and communication, and it can certainly result in a higher level of business-IT alignment. However, decentralisation, or

the ‘localism’ agenda in the UK, has been found to be a barrier to both. The UK Localism Act was created in 2011 and is concerned with decentralisation by devolving power from central government to individuals, communities and local authorities (Great Britain, National Archives 2018b).

The localism agenda seeks to move power and responsibility to a local level. Local councillors tend to believe that their responsibility is to serve the needs of the local community who elected them and may find that the way to do this is by having increased control and ownership. As mentioned by a participant from IT, in regard to standardisation and communication, “the issue is the desire of individual local government to keep control of their own service”. There will be a lower level of horizontal and vertical communication and standardisation if government agencies operate autonomously and focus on serving local needs without any outside influence. Therefore, decentralisation is seen to decrease both standardisation and communication, as illustrated in Figure 1.

Nonetheless, this paper believes that when a government agency is experiencing a low level of communication with other government agencies (e.g., the type that allows for more standardisation), the potential disadvantages associated with decentralisation will increase (e.g., performing service redesign with minimum alignment). As a result, it is seen that communication can reduce many of the barriers linked to decentralisation (Figure 1).

One of the IT respondents pointed out that localism is a significant barrier to standardisation. It was stated that “you can see at least in theory, that the idea of having all councils using a common IT platform for delivery of things like council tax administration, you can see the attraction of it, but that is at odds with the localism agenda”. In order to successfully achieve standardisation, local authorities must understand that it will not necessarily reduce their ability to serve local needs. Additionally, standardisation (e.g., common services redesign standards) can create more alignment, consistency and cohesion, by setting a common approach to services redesign across LAs, and between central and local government, and therefore can reduce barriers associated with decentralisation (e.g., siloed approach to service redesign). Therefore, standardisation can reduce the disadvantages associated with decentralisation, as shown in Figure 1.

There should be a shift in thinking from the perception that decentralisation means operating in a silo, or that communication and standardisation preclude autonomy. Rather, there should be an emphasis on the ways that communication and standardisation can best serve local needs, by creating more alignment between business and IT, across local authorities and between central and local government.

The paper argues that the creation of a platform by central government from which it is possible to communicate with local authorities will allow the barriers which come alongside decentralisation or localism agenda to be addressed. This will enable greater standardisation and SDK in the UK public services redesign.

Based on these findings, and as part of the ‘theory for design’ that this paper offers (for practical usefulness), it can be argued that alignment issues might be best addressed by adopting a *network* arrangement across government. Ideally, this would be a goal-directed arrangement aimed at alignment in services redesign, and mandated or contracted by the UK government, rather than adopting a siloed approach to services redesign. The network would be comprised of a cross-functional team or a multi-disciplinary group from across the UK public sector, with a common purpose and goal of creating more alignment in public services redesign. Having a collective approach towards services redesign will enable them to align and achieve outcomes they wouldn’t be able to achieve while operating in silos, and to minimise the inherent complexities of alignment. As posited by Provan and Kenis (2008, p. 2), network effectiveness compromises “the attainment of positive network-level outcomes that

could not normally be achieved by individual organisational participants acting independently”.

Nevertheless, there are many benefits of networks for alignment and coordination, including reciprocity, efficiency and stability (Oliver, 1990, cited in Ebers, 1997). Reciprocity means the existence of a shared goal of increasing the level of business-IT alignment in UK services redesign. Secondly, an efficient and smarter decision making will help bring about a more productive use of resources (e.g., to reduce duplications and cost), and more efficient development of services (e.g., by increasing standardisation, and the development and use of shared services). A goal-directed network will also enable any concerns or uncertainty relating to stability and the ability to maintain alignment between the business and IT faced by organisations to be shared and communicated with other participating public sector organisations, and therefore addressed in a cooperative manner.

## CONCLUSIONS

This paper focuses on the key factor and enabler of alignment, i.e., communication. It explains the level of horizontal and vertical communication in the UK public services redesign. This research provides a theoretical model to deepen our understanding of this phenomenon, and demonstrate the interrelation between communication and other key factors identified from data collected which are also found to produce more alignment (i.e., standardisation and SDK). It discusses the fact that decentralisation is an alignment inhibitor and explains how it negatively affects horizontal and vertical communication and standardisation in the UK services redesign.

Based on the findings, a network arrangement is proposed to increase the level of alignment, and to establish a collective approach and actions towards services redesign. It also provides government agencies with recommendations to improve their BIA, in order to support service redesign. It provides original concepts, ideas and insight by progressing and building on existing knowledge and understanding of business-IT alignment in the context of UK government digital service redesign.

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## AN EXAMINATION OF THE RELATIONSHIP BETWEEN PERCEIVED BODY IMAGE AND PURCHASE BEHAVIOUR OF DIETARY SUPPLEMENTS AMONG ADOLESCENT SAUDI GIRLS

EID ALOTAIBI<sup>1</sup> AND HEBAH JAMAL<sup>2</sup>

### ABSTRACT

The main objective of this study is to investigate the relationship between perceived body image and purchase behaviour related to dietary supplements among adolescent Saudi girls. Drawing on the theory of planned behaviour (TPB) and Silhouette's nine figure scale, this study seeks to further contribute to our understanding of how perceived body image affects customers' behaviour toward dietary supplements consumption. Cluster analysis is employed to classify the consumers into two groups according to their body image perception. The first cluster is determined as negative body-image and the second cluster is called positive body-image. Independent samples t-test showed that there is a significant difference between the two clusters in terms of their actual purchase behaviour and behaviour intention towards dietary supplements. The findings reveal that negative body-image is significantly associated with both behaviour intention and actual purchase behaviour towards dietary supplements. Unlike the negative body-image group, the findings show that there is a weak relationship between the positive body-image group and behaviour intentions/actual purchase behaviour towards dietary supplements. The study offers theoretical and managerial implications and suggests further consideration to be given to the link between body-image and purchase behaviour and behavioural intention.

**Keywords:** Perceived body image, Purchase behaviour, Dietary supplements, Adolescent.

### INTRODUCTION

Adolescence represents a period of rapid physiological development and psychosocial maturation associated with changes in body perception (Ramberan, Austin and Nichols, 2006). It is considered as a crucial stage of life that brings many biological, neurocognitive, social and behavioural changes (Gottlieb et al., 1998). Adolescence describes the transitional stage from childhood to adulthood. It was defined by the Committee on the Rights of the Child (CRC) as "a life stage characterised by growing opportunities, capacities, aspirations, energy and creativity, but also significant vulnerability" (UN Committee on the Rights of the Child, 2016). More precisely, the World Health Organization (WHO) defines adolescents as those people between 10 and 19 years of age. Adolescence-related issues have become of great interest for many researchers over the past few years, with more focus on issues related to obesity and dietary supplements usage (e.g. Alfawaz et al., 2017; Ebbeling et al., 2017; Karayiannis et al., 2018; Musaiger, 2004; Torbahn et al., 2017). This rapidly-growing field of research gains its importance from the unique nature of such a critical period of formative growth and development that profoundly affects health and well-being across the life course.

Saudi Arabia, like any other developing country, went through many rapid socio-economic changes during past decades. Such changes have greatly affected the lifestyle of the entire population. For instance, the traditional Saudi diet was replaced by the energy-dense Western diet that cause an increased prevalence of some diseases such as obesity, type 2

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diabetes and hypertension (Al-Hazzaa, 2002; Musaiger, 2002). Moreover, fast food consumption and increased caloric intake, in combination with a sedentary lifestyle, is associated with rising rates of obesity in Saudi society (Musaiger, 2004). According to the annual statistics for food consumed in the Gulf Cooperation Council (GCC) in 2014, Saudi Arabia was first in terms of the amount of annually consumed food (Statistica, 2014). In 2012, the amount of consumed food in the country totaled some 25.8 million metric tons, compared to 29.6 million metric tons in 2014 (961.6 kilograms per capita). This is of heightened relevance to the current study as adolescents have become especially vulnerable to intense marketing efforts by manufacturing companies to promote unhealthy snacks, since they represent future adult consumers (Story and French, 2004).

The latest annual report of the Saudi General Authority for Statistics shows that 68% of the total population are below the age of 35, of which 27% are adolescence (SGAS, 2018). Therefore, Saudi adolescents girls is the main group exposed to and affected by high fast food consumption behaviours in the region (Al-Faris et al., 2015). According to Ng et al. (2011), 71% of Saudi females are either overweight or obese. This, of course, explains the high prevalence of dietary supplement use among females in Saudi Arabia. Alfawaz et al. (2017) found that the prevalence of dietary supplement use was high among Saudi female adolescence and it was significantly associated with socio-demographic and lifestyle factors. This prevalence of dietary supplement was supported by a tremendous expansion of the pharmaceutical market in Saudi Arabia. According to the Saudi Pharmaceutical Sales Forecast for the current year (2018), industry products are expected to surpass \$7 billion by 2018 as compared to \$4 billion in 2012; the supplement market accounts for 4% of total pharmaceutical market sales.

From a social-psychological perspective, the theory of reasoned action (TRA) (Fishbein and Ajzen, 1980) provides a useful conceptual framework for predicting and exploring a wide variety of different dietary behaviours (e.g. Backman et al., 2002; Blanchard et al., 2009; Pawlak and Malinauskas, 2008). This research will, however, adapt the theory of planned behavior (TPB) in order to enhance our understanding of the relationship between perceived body image and purchase behaviour for dietary supplements among adolescent Saudi girls. Although the pharmaceutical industry in Saudi Arabia is expected to surpass \$7 billion by 2018, it still lacks in-depth market research, especially for dietary supplement consumption. Previous researchers have not adequately addressed the issue of Saudi adolescents' consumption of dietary supplements from the marketing perspective. Therefore, this study utilises TPB to fill this gap and to (1) predict adolescents' consumption behaviour, and (2) segment adolescent consumers based on their consumption behaviour towards dietary supplements. Furthermore, the study provides a contribution for both marketing knowledge and practice for dietary supplement marketing.

## LITERATURE REVIEW

### Body image

Body image is a subjective multidimensional and dynamic construct that includes cognitive, behavioural and emotional components (Thompson, 2004). It reflects individuals' perceptions, thoughts and feelings about their body including body size estimation, evaluation of body attractiveness, and emotions associated with body shape and size (Grogan, 2008). From a social-psychological perspective, body image is defined as "the mental picture one has of his or her body at any given moment in time" (Kaiser, 1997, p. 98). Previous research shows that body image incorporates two main aspects: body perception (an individual's assessment of the physical aspects of their body) and body satisfaction (the extent to which an individual is (dis)satisfied with their body size and shape). Individuals' perception of the physical aspects of their body will result in either body image satisfaction or

dissatisfaction. Therefore, body image dissatisfaction is defined as the negative perceptions and feelings an individual has about their body (Peat et al, 2008; Slevic and Tiggemann, 2001).

Body image is not fixed or static, but rather a dynamic aspect of one's self that changes over time and is developed in social comparison (Andrew, Tiggemann and Clark, 2016; Zach et al., 2013). Burns (1979) argues that body image is a significant component of self-concept which influenced by self-esteem and self-evaluation. Positive body image occurs when an individual has positive thoughts and feelings about him/herself, while negative body image is associated with negative thoughts and feelings. Most of body image research focuses on a discrepancy between how one sees one's self (actual/own) and how one would ideally like to be (ideal/own), while acknowledging that such discrepancies are related to body dissatisfaction along with other negative psychological outcomes (Thompson and Gray, 1995). Therefore, self-discrepancies play an important role in the context of body image and appearance-related behaviours (Szymanski and Cash, 1995; Vartanian, 2012). One's positive feelings about appearance are dependent on how close the actual physical self is to the ideal one (Burns, 1979; Solomon, 2017). Thus, the greater the discrepancy between actual and ideal body image, the greater will be the negative feelings about one's physical appearance while, on the other hand, the smaller the discrepancy between the ideal and the actual body image, the more positive one will feel about one's own appearance (Solomon, 2017). Henderson-King, Henderson-King and Hoffman (2001) reported that women who viewed ideal images of models expressed negative feelings about their own bodies and rated their own body image lower than women who viewed neutral images.

Most of the research on body image dissatisfaction has focused on adolescence girls as they represent a pivotal stage in the development of positive or negative body image (Ata et al, 2007; Dohnt and Tiggemann, 2006; Ferraro et al., 2008). For example, Pesa et al (2000) studied the psychosocial differences associated with body weight among female adolescents. The purpose of their research was to determine whether overweight female adolescents differ from normal and underweight female adolescents with respect to a set of psychosocial factors, while controlling for body image. The findings revealed significant differences between groups on the combined set of psychosocial factors. Self-esteem defined the difference in a positive direction while grades defined the difference inversely. However, when controlling for body image, multidimensional group differences were still evident, while self-esteem was no longer a significant contributing variable. In their pilot study, Jansen et al. (2008) tested if body exposure and describing one's body in a neutral way is an effective approach for increasing body satisfaction in obese adolescents. The results of their study indicate that adding body exposure and neutral description of one's body to a weight reduction programme might be an effective way to increase body satisfaction in obese adolescents. Moreover, the exposure was shown to be a powerful strategy to decrease anxiety and to increase body satisfaction. Also, body weight at post-treatment was a significant predictor of positive feelings.

Douthitt (1994) investigated the psychological determinants of adolescent exercise adherence. The findings of Douthitt's research indicated that 'perceived romantic appeal' was predictive of male exercise adherence while 'perceived athletic competency', 'perceived global self-worth', and 'perceived physical appearance' were predictive of female exercise adherence, while 'perceived romantic appeal' and 'personality/sport congruence' were predictive of non-competitive subjects' exercise adherence. Most recently, Musaiger, Bin Zaal and D'Souza (2012), examined body weight perception among adolescents in Dubai. The results show that overweight and obese adolescents were more likely to face pressure from their parents and be teased by friends than non-overweight/-obese adolescents.

Compared to their current body image, overweight and obese adolescents chose a significantly lighter figure as their ideal compared to their actual body image.

The relationship between body image and adolescents' consumption behaviour is well established in existing literature. For example, Yoo and Yurchisin (2017) conducted a research to examine the associations among sociocultural attitude towards appearance, gender, body mass index, and adolescents' appearance-related behaviours and appearance-enhancing product use. The results revealed that sociocultural attitude towards appearance, gender, and body mass index positively influenced adolescents' appearance-related behaviours and product use. Adolescents who highly valued sociocultural attitude towards appearance were likely to engage in behaviours and use products that were designed to increase their attractiveness. In line with Yoo and Yurchisin's research, Dickman (2010) examined the relationship between body image and cosmetics consumption among female adolescents. The findings show that cosmetics consumption behaviours like compensation and concealing were used when subjects felt dissatisfied with their body. It was also found that the time they used for fixing their appearance had a positive relationship with their body image dissatisfaction.

### **Purchase behaviour**

Consumers' purchase behaviour has long been of interest to researchers. It has been much discussed at a conceptual level, starting with the seminal work of Howard and Sheth (1969). Consumer behaviour has been defined as "the behaviour that consumers display in searching for, purchasing, using, evaluating, and disposing of products and services that they expect will satisfy their needs" (Schiffman and Kanuk, 2007, p. 3). According to Batra and Kazmi, (2004), consumer behaviour refers to "the mental and emotional processes and the observable behaviour of consumers during searching for, purchasing and post consumption of a product or service". These definitions imply that consumer behaviour is not merely an economic theory, but rather it is an interdisciplinary science that involves theories from all social and psychological sciences concerned with human behaviour, such as psychology, sociology, ethnography, marketing and economics theories (Levy, 1983). Therefore, behavioural scientists employed several socio-psychosocial theories in order to understand and explain adolescents' consumption behaviour.

The theory of buyer behaviour (TBB) (Howard and Sheth, 1969) provides an integrated model that explains consumer behaviour through various social, psychological and marketing influences on consumer choice into a coherent sequence. The model delineates four main components of information flow: 1) inputs; 2) perceptual constructs; 3) learning constructs, and; 4) outputs. These four components cover all buying behaviour elements including marketing, social stimuli, attention, information search, motives, choice criteria, brand comprehension, leading to an attitude, confidence, intention, satisfaction, purchase, intention, attitude, brand comprehension and attention (Howard and Sheth, 1969).

One of the most widely applied theories in studying adolescents' consumption behaviour is the theory of planned behaviour (TPB) (Ajzen, 1988; 1991). The TPB is the extended version of the theory of reasoned action (TRA) (Fishbein and Ajzen, 1980) which provides a useful conceptual framework for predicting and exploring a wide variety of different dietary behaviours (Backman, 2002; Blanchard et al., 2009; Pawlak and Malinauskas, 2008). The rationale behind the TPB is that one's behaviour is governed by one's intentions to commit a specific act at a specific time and place. In other words, individuals' behavioural intentions are subject to three antecedents: (1) their attitude toward the behaviour; (2) subjective norms, and; (3) perceived behavioural control (Ajzen, 1991; Fishbein and Ajzen, 1980). The first antecedent of behavioural intention (attitude) is determined by the individual's beliefs about the consequences of performing the behaviour

(behavioural beliefs). Thus, an individual's intention to perform a certain behaviour will depend on their positive/negative evaluation of that behaviour. The TPB suggests that attitudes have a direct impact on behavioural intention and are linked with subjective norms and perceived behavioral control. Subjective norms, on the other hand, are the second antecedent of behavioural intention and are a function of beliefs as well. It is argued that an individual will intend to perform a certain behaviour when (s)he perceives that significant others think (s)he should (Fishbein and Ajzen, 1980). Finally, perceived behavioural control (the third antecedent) refers to an individual's perception of the ease or difficulty of performing the particular behaviour (Ajzen, 1987).

The findings from previous studies provided strong support for the use of the TPB in adolescents' consumption behaviour context. For instant, Marcoux and Shope (1997) applied the TPB to predict and explain alcohol use and misuse among young adolescents. The findings suggest that the theory is useful in predicting and explaining alcohol use, frequency of use and misuse among adolescents. The relationship between intention and behaviour explained 26% of the variance in alcohol use, 37% of the variance in frequency of alcohol use and approximately 30% of the variance in alcohol misuse. Blanchard et al. (2009) found that behavioural intentions were a significant predictor of students' consumption of fruit and vegetables. Similarly, Pawlak and Malinauskas (2008) employed the TPB model to examine adolescents' prevalent beliefs regarding eating fruits. Their findings revealed that subjective norms had positively significant impacts on the intention to eat fruit. The TPB has been utilised in various study contexts including online purchases (Hansen, Jensen and Solgaard, 2004); smoking behaviour (Guo et al., 2007); appearance-related behaviour (Yoo and Yurchisin, 2017); and dietary behaviour (Backman, 2002; Blanchard et al., 2009; Pawlak and Malinauskas, 2008). All these studies provided strong support for the use of the TPB in various behavioural contexts.

From a marketing perspective, marketing researchers have become more interested in market segmentation and identifying potential markets to small homogenous groups or segments, especially with the prevalence of dietary supplement use among adolescents (Alfawaz et al., 2017; Alves and Lima, 2009). Adolescents' market segmentation research show that that adolescents have different decision-making styles from adult consumers (Singh and Singh, 2017). Therefore, this study will apply TPB to a segment of adolescent consumers based on their consumption behaviour towards dietary supplements.

## METHODOLOGY

The study aims to investigate the relationship between perceived body image and purchase behaviour towards dietary supplements among adolescent Saudi girls. The study questionnaire was generated based on the intensive literature review. It has three parts. Part one measures consumer perception of body image (actual vs ideal), part two deals with consumption behaviour, and part three measures consumers' intention to buy dietary supplements. For part one, respondents were presented with nine figures of different body images, thinner to fatter (Stunkard, Sorensen and Schulsinger, 1983). Then, they were asked to select the figure that most closely matched their current body-image, as well as the figure that most represented what they would ideally look like, in addition to rating their (dis)satisfaction with their actual body image. Part two consisted of three items that measured respondents' consumption behaviour, while the last part included four items to measure consumers' intentions to buy dietary supplements. For both scales (purchase behaviour scale and behavioural intention scale) a five-point Likert-type scale was used, where 1= strongly disagree and 5=strongly agree.

The target population for the study were Saudi female adolescents aged between 11 to 19 years old. For survey validation, a pilot study was conducted and errors were amended

based on comments and feedback received from participants. The final questionnaire was distributed in five major cities in Saudi Arabia (representing the main five regions) over three months (between May and July 2017). These cities were Riyadh (the capital city), Jeddah, Makkah, Medina, and Hofuf. A cross-sectional survey was conducted amongst 735 adolescent Saudi girls selected from government schools using the stratified random sampling technique. After accounting for non-response and incompleteness, 550 was retained for further analysis.

## DATA ANALYSIS AND FINDINGS

The findings show that most of the respondents aged between 14 and 17 years old. 65% of them are not satisfied with their current looks, while 83% chose an ideal/attractive body shape different from their own actual/ current body. Reliability analysis was run to assess the scales' internal consistency, followed by cluster segments validity and independent samples t-test.

### Reliability

Reliability analyses were carried out on the purchase behaviour and behavioural intention scales. The results of these analysis indicated that the scales were internally consistent with substantial alpha coefficients. Then a k-mean cluster analysis was employed to segment the customers into two groups according to their perceived body image. Finally, independent samples t-tests were used to examine the impact of body image on customers' purchase behaviour.

#### *Reliability of the purchase behaviour scale*

The internal consistency of the purchase behaviour scale was estimated using Cronbach's Alpha statistics. Table 1 shows the reliability of the scale as well as the mean and standard deviation of each item:

**Table 1. Reliability, mean, and SD of purchase behaviour scale (N=550)**

The Scale	Mean	SD	Cronbach Alpha	Item-to-total Correlation
Purchase Behaviour	3.20	1.30	0.84	
I buy dietary supplements regularly.				0.85
Buying dietary supplements is important to me.				0.79
I will be using dietary supplements in future too.				0.83

From table 1, all three sub-scales exceeded the minimum recommended internal consistency threshold of 0.70 and were therefore deemed reliable (Churchill, 1979). The overall Cronbach's Alpha coefficient is 0.84. Item-to-total correlation coefficients were high for the three sub-scales and ranged from 0.79 to 0.85. Therefore, the scales showed good internal consistency.

#### *Reliability of the behaviour intention scale*

The internal consistency of the behavioural intention scale was estimated using Cronbach's alpha statistics. Table 2 shows the reliability of the scale as well as the mean and standard deviation of each item.

**Table 2. Reliability, mean, and SD of behavioural intention scale (N=550)**

The Scale	Mean	SD	Cronbach Alpha	Item-to-total Correlation
Behavioural Intention	3.65	1.20	0.94	
I definitely do intend to take dietary supplements.				0.90
I definitely do plan to take dietary supplements				0.88
I definitely do want to take dietary supplements.				0.76
I would like to take dietary supplements				0.85

From table 2, the Cronbach's Alpha coefficient for the behavioural intention scale is 0.94, exceeding the minimum recommended internal consistency threshold of 0.70 and is therefore deemed reliable (Churchill, 1979). Item-to-total correlation coefficients ranged from 0.76 to 0.90 and therefore the scale items displayed good internal consistency.

### Segmenting respondents according to perceived body image: k-mean cluster analysis

The objective of cluster analysis is to cluster or group observations into subsets based on the similarity of responses (Arabie and Hubert, 1994). According to Sarstedt and Mooi (2014), a k-mean cluster analysis is preferred if (1) there are many observations (> 500) in the dataset and (2) the researcher has a priori knowledge regarding the number of clusters. The current study has observations > 500 and two clusters are expected to come up based on respondents' perception of their body image (satisfaction versus dissatisfaction). Therefore, a k-means clustering procedure was utilised on the perceived body image items to identify the number of consumer segments (Hair et al, 1998). The results show two clusters of respondents. The first cluster was called 'negative body image' and the second cluster was called 'positive body image'. The 'negative body image' cluster constituted 54% of the total segments whereas the 'positive body image' cluster constituted 46%. Table 3 summarizes validation of the cluster groups.

**Table 3. Validating the cluster segments**

	Cluster1:	Cluster2:
Negative Body-Image	296	0
Positive Body-Image	0	254
*Total	550	

\* $X^2=127$ ,  $df=2$ ,  $p<.00$

By looking at table 3, it can be seen that most of the respondents fall in cluster 1 (296 out of 550), while cluster 2 consists of 254 respondents.

### Differences between cluster groups: independent samples t-test

Analysis was carried out to test whether there is a significant difference between the two clusters in term of their behaviour toward dietary supplements consumption. To this end,

independent samples t-tests were undertaken with the two clusters ('negative body image' and 'positive body image') as grouping variables. Table 4 presents the t-tests results.

**Table 4. Independent samples t-test results**

Variable	Cluster Groups	N	Mean	S.D.	t-Value	p-Value
Purchase Behaviour	Negative Body-Image	296	3.45	1.77	4.06	0.00
	Positive Body-Image	254	2.15	.85		
Behavioural Intention	Negative Body-Image	296	3.56	.65	3.96	0.00
	Positive Body-Image	254	2.32	1.32		

As can be seen on Table 4, the *p*-value of the t-tests indicate that there are significant differences between the two groups with regard to their actual purchase behaviour of dietary supplements ( $p = 0.00$ ,  $t = 4.06$ ), and behavioural intention ( $p = 0.00$ ,  $t = 3.96$ ). On the one hand, the 'positive body image' cluster recorded a small mean score of purchase behaviour (2.15), and intention to buy dietary supplements (2.32). On the other hand, the 'negative body image' cluster scored higher on purchase behaviour (3.45), and behavioural intention (3.56). Overall, it is clear that the 'negative body image' cluster had a higher tendency toward buying dietary supplements compared to the 'positive body image' cluster.

## DISCUSSION

This study aimed to examine the relationship between perceived body image and purchase behaviour towards dietary supplements among adolescent Saudi girls. There are two motives for this study: (1) previous researchers did not adequately address the issue of Saudi adolescents' consumption of dietary supplements from a marketing perspective, and (2) there is a relatively young population in Saudi Arabia, where 68% of the total population are below the age of 35 and of which 27% are adolescence (SGAS, 2018). The population also associates with high prevalence rates of overweight and obesity (DeNicola et al., 2015). According to the Saudi Pharmaceutical Sales Forecast for the current year (2018), industry products are expected to surpass \$7 billion by 2018 as compared to \$4 billion 2012, of which the supplement market accounts for 4% of the total pharmaceutical market sales. This boom in the Saudi pharmaceutical industry still lacks in-depth market research, especially for dietary supplement consumption. Therefore, the findings of this research fill this gap.

By adapting the theory of planned behavior (TPB), this research examined the prediction of dietary consumption intention and behaviour in a sample of Saudi female adolescents who were between 11 and 19 years old. The K-means cluster analysis showed two clusters of respondents. The first cluster was called 'negative body image' and the second cluster was called 'positive body-image' (see Table 3). The 'negative body image' cluster constituted 54% of the total segments whereas the 'positive body image' cluster constituted 46%.

The findings of the independent samples t-test indicated that there are significant differences between the two groups with regard to their actual purchase behaviour of dietary supplements, and behavioural intention. It has been argued that the greater the discrepancy

between actual and ideal body image, the greater will be the negative feelings about one's physical appearance (Burn, 1979; Solomon, 2017). In this study, the 'negative body image' group are those respondents who recorded a high discrepancy between their current body image and ideal body image, while the 'positive body image' cluster consists of those adolescents whose actual body image is close to their ideal one.

In line with previous research (e.g. Yoo and Yurchisin, 2017; Dickman, 2010). the findings of the current study confirm the positive relationship between body image dissatisfaction and adolescent purchase behaviour. More precisely, consumption of dietary supplements is significantly related to body image dissatisfaction. Moreover, respondents who reported higher score on body image dissatisfaction have a greater tendency to buy dietary supplements compared to those who were satisfied with their body image. The findings also suggest that adolescents who are satisfied with their current image show low tendency to buy dietary supplements. Overall, the findings stress the importance of TPB in predicting adolescents' behaviours. Attitude was a significant predictor of adolescents' intentions to buy dietary supplements.

### **IMPLICATIONS AND FURTHER RESEARCH**

The results of the current study create several theoretical and practical implications. To the best of the authors' knowledge, this is the first study that discusses adolescents' dietary supplements from a marketing perspective in Saudi Arabia. Therefore, it provides compelling ground for further research on this area. The findings also draw researchers' attention to the fact that not all adolescents' girls behave similarly in terms of their consumption behaviours. The final clusters provide a new insight into marketing research. Therefore, researchers should handle adolescents' studies with more care, taking into account the various factors that may affect the outcomes. It is obvious that applying TPB to adolescents' marketing research is helpful and can provide a holistic understanding of their consumption behaviour.

From a managerial perspective, the findings suggest that marketers need to segment their market based on customer needs. Understanding customer needs will help managers to tailor products/services to suit their targeted segment group (negative vs positive body image). Marketing campaigns and advertisements should revolve around the notion of 'ideal body image' which has a strong relationship with product consumption behaviours (Dickman, 2010). Moreover, consumption behaviour is highly affected by personal (e.g. demographic, gender, age), psychological (e.g. self-image, personality traits, lifestyle, motivational), and social factors (e.g. cultural, social class, society/family) influences. In order to create an appropriate marketing mix (MM) for their target market, marketers must pay more attention to these factors.

Future research could further test the difference between female and male adolescents in order to determine the proper market segmentation. Another interesting venue of research could be to examine the relationship between self-image congruence and dietary supplement consumption. The findings of previous research emphasises the role of self-concept on specific behaviour (Guttman, 1973), implicit behaviour patterns (Greeno, Sommers and Kernan, 1973), and perception of product (Hamm and Cundiff, 1969). The notion behind this research is that consumers always attempt to preserve, enhance, or extend their self-image (perception of self) by purchasing products that enhance their ideal image (Sirgy, 1982). Therefore, future research can apply self-image theory into adolescent behavior studies. It is suggested that consumer behaviour is not merely an economic theory, but rather it is an interdisciplinary science that involves theories from all social and psychological sciences concerned with human behaviour. Thus, future research should benefit from the different social-psychology theories in order to develop new methods for body image and consumption behaviour research.

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**SERVICE DEVELOPMENT MODELS: A LITERATURE REVIEW**MUHAMMAD AHMAD TAUQEER<sup>1</sup> AND KNUT ERIK BANG<sup>2</sup>**ABSTRACT**

The service sector is increasingly recognised as having come to dominate the business market globally. The aim of this study is to investigate and synthesise published literature related to service development models and frameworks, and to identify areas for improvement. The study evaluates the state of the art in service development models and frameworks between 2000 and 2017. The literature review reveals that, despite services being the major economic driver, limited research related to service development has been carried out. The research methodology used in the existing studies can be categorised as (i) conceptual, (ii) evidence-based and (iii) anecdotal. These models and frameworks present four generic service development steps, i.e., idea generation, business model, testing and launch. Among these, idea generation displays significant room for improvement.

**Keywords:** New service development; Service innovation; Service design; Service engineering, Literature review.

**INTRODUCTION**

Industry has witnessed a paradigm shift from product-centric business models to service-centric models (Spohrer et al., 2007; Spohrer and Maglio, 2010; Lusch and Vargo, 2011). The service sector plays a predominant role in developed economies, comprising 70% of the gross domestic product (GDP) and employability (Porter, 1985). The service market has increased globally and the major sources of revenue in the developed economies derive from the service sector, while developing economies are also swiftly growing towards services, and often characterise half of their GDP as services. Globally, nearly 64% of GDP comes from the service sector, according to the *World factbook* (CIA, 2009).

Due to globalisation and rapid technology development, modern markets have become extremely volatile. This has increased the demand for innovation and reduced products' shelf life. Through past experience, it has been observed that the service market is more sustainable than the product market (Chesbrough, 2011). Although the service market has already outperformed the product market, this difference is projected to increase to a level where services will absolutely dominate the market. Harvard Professor Theodore Levitt has explicated to his students that the customer is not interested in the product itself but the effect of the product (Christensen, Cook and Hall, 2005; Chesbrough, 2011). Similarly, Drucker stated: "what the customer buys and considers value is never a product. It is always utility — that is, what a product does for him" (Drucker, 2012, p. 57). These scholars set forward the conclusion that it is not the product that the customers are willing to pay for but the service that the product delivers to them.

Recently, many high-tech companies have shifted their business models from offering products to offering services. Aerospace engine producers like General Electric and Rolls-Royce have transformed their business models from selling jet-engine units to jet-engine operational hours, i.e., the utility aircraft that operators are looking for. Nowadays, even in technology companies, the prime revenue stream is from the services offered by the company. For instance, in the oil and gas business, the majority of companies are oil service

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companies and a greater portion of the business in these companies is to deliver services. The services provided by companies and personnel are specialised, based on technology, and range from the largest drilling rigs to the smallest measurement tools. Traditional manufacturing companies are also turning to providing mainly services and using their previous manufacturing capability as the means to gain competitive advantage in delivering technology-based services.

The paradox in the present scenario is that, despite the service sector being the major economic driver, only nominal research has been carried out in order to learn how to develop and innovate services. Saco and Goncalves (2008) have acknowledged that service design is still in a stage of evolution and the existing research work does not provide firm ground to understand the service development phenomenon. Service design lacks cohesive and explicit models and frameworks (Clatworthy, 2011; Ostrom et al., 2015). Therefore, there is a need to investigate the published knowledge and propose areas for improvement and expansion.

A few literature reviews have been carried out on service development. They do not fulfill the need because either (i) they are outdated or (ii) they present different statistics on service development literature and not the content insights.

The outdated literature reviews include those by Johne and Storey (1998), in which the authors evaluated articles related to service development published up until 1996. Similarly, Menor, Tatikonda and Sampson (2002) and Goldstein et al. (2002) performed literature reviews relevant to service design. De Jong and Vermeulen's (2003) literature review was related to organising for service development. These reviews had limited literature relevant to service development available at that time and are nearly fifteen years old.

In a newer era, statistical literature reviews, like that of Papastathopoulou and Hultink (2012), have been performed, with the main focus on publication statistics. The key features of the study comprise a compilation of academic journals that have published the highest number of articles, the distribution of articles in different periods, and the key research topics. Similarly, Biemans, Griffin and Moenaert (2016) carried out a literature review, in which top journals of service development literature were identified and their citations discussed. Different statistical analyses were performed to discover new service development topics per journal, number of articles on different service development topics, key researchers in this field, distribution of researchers in different parts of the world and high-impact articles. These literature reviews provide a deep statistical insight into how the research work has evolved over time, journals that are suitable for publishing service development articles, and leading researchers in this field. However, these studies lack evaluation of the content of the articles, characterisation of the content, summaries of the key findings and useful areas that remain unexplored, specifically in service development. These studies provide useful information to the researchers working in the field of service development, but inadequate knowledge is presented to entrepreneurs, startup leaders or service developers that want to learn methods and useful guidelines from the published literature.

The objective of the present study is to provide an insight into the existing models on developing services, to characterise research methods, orchestrate research findings and to suggest research questions (RQ) for further improvement.

The remainder of this paper is structured as follows: a brief historical perspective of product and service characterisation and the terminology used in the published literature to refer to the service development process are discussed in the following section. The subsequent section discusses the search methodology used in the present study, followed by results and discussion. Finally, limitations and future research perspectives are discussed and conclusions are drawn. RQ are developed throughout the following sections.

### Characterisation of product and service

There has been discussion in the published literature, regarding characterising and distinguishing the product and service. Services cover a wide range of complex activities that are difficult to describe with a single definition. The definitions of service can be as simple as the action of benefiting or the conduct of providing an advantage to another and as complex as including the aspects of perishability, inseparability and intangibility to distinguish service from a product (Grönroos, 1978). From a historical viewpoint, the product was defined as anything that has tangible possession, ownership rights and reserves the ability to transfer ownership rights against a particular value. Similarly, services were classified as offerings that are intangible, perishable and, simultaneously, produced and consumed (Smith, 1776). A slightly different approach is to define a product as anything that can be offered to a market that might satisfy a want or need, whereas services are economic activities that bring about desired results to recipients (Kotler et al., 2006).

There are features which overlap products and services in these definitions resulting in a few items which cannot be precisely categorised as a product or service. The only distinguishing feature between products and services in the present time of complex products and services is tangibility. Products can be perishable and separable, for instance food products. Correspondingly, services can be non-perishable and inseparable like long-term remote maintenance services. However, distinguishing products and services based on tangibility is ambiguous. Modern products have elements of intangibility, for example, stock exchange shares. Similarly, services such as drilling services in the oil and gas industry and hotel services involve physical assets, for example, drilling rigs and hotel beds, respectively.

An idea, first suggested by Rathmell (1966) and further elaborated by Shostack (1977), is to distinguish product from service on a continuum, ranging from tangible-dominant to intangible-dominant. Here, tangibility includes physical elements and ownership. There would potentially be items towards the centre of the scale that are difficult to classify as a product or service. Nevertheless, this approach sets the basis for defining products and services. From the modern perspective, products and services can essentially be distinguished on a scale of the degree of intangibility associated with an item, and this definition serves as the source for understanding products and services. Therefore, services are defined as items falling towards the intangible-dominant side on a scale of tangible-dominant to intangible-dominant, where tangibility represents both physicality and ownership of the item.

**RQ1:** *How can items (products or services) falling in the centre of the intangibility scale be distinguished? How can the degree of intangibility be measured for products and services?*

### Terms related to service development

Analogous to different perceptions of product and service definitions in the literature, different terms are also in evidence regarding service development and service innovation processes. The term ‘service design’ is present in abundance in publications referring to the process of service development from idea to specifications (for example, Zeithaml, Parasuraman and Berry, 1990). Service design is essential in order to keep up the innovation process (Sangiorgi and Junginger, 2015). Pinherio (2014) has discovered opportunities for startup leaders and entrepreneurs to integrate a service design framework in their initial stages of development. The theoretical relevance and the practical applications of service design are discussed by Sangiorgi (2009) and Kimbell (2011). Service design is a holistic approach for creating new services (Blomkvist, Holmlid and Segelström, 2010), involving assessment, ideation, deliberation, and implementation (Bitner and Brown, 2008). Service design has been developed by management fields such as marketing and operations management (Bitner and Brown, 2008; Cook et al., 2002).

‘New service development’ is also a commonly used term, analogous to ‘service design’ (Cooper et al., 1994; Edvardsson et al., 2000; Johnson et al., 2000). Similarly, Gummesson (1991) has defined new service development as the characterisation of service development in terms of drawings and flowcharts. This incorporates service research fields such as service marketing, service management and available technology (Patricio, Fisk and Cunha, 2003).

Service innovation also appears in the literature in different ways. For example, Edvardsson et al. (2000) referred to idea generation in the new service development process as ‘service innovation’, contrary to Sundbo (1998), who refers to service innovation as the entire process of new service development. Goldstein et al. (2002) reviewed the literature on the service concept and highlighted different nomenclature used in the published literature to refer to similar principles. Service innovation is dependent on technology and service design where both technology and service design are interlinked (Ostrom et al., 2015).

Service engineering is also adequately used to express service development in the published literature (Bullinger, Fähnrich and Meiren, 2003). Tomiyama (2001) studied how to establish service engineering that is intended to include the service content of product life cycles.

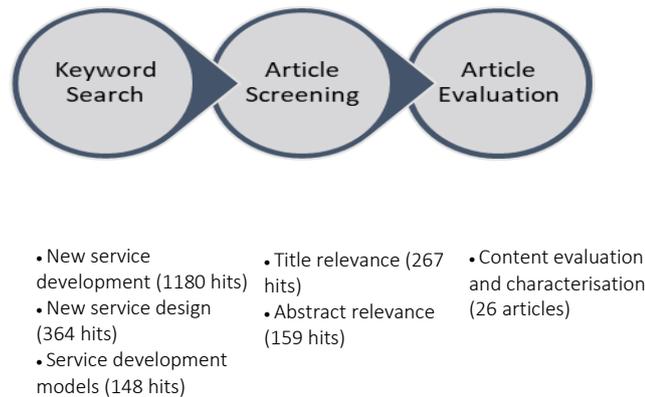
It is observed that the terms ‘service design’, ‘new service development’, ‘service innovation’ and ‘service engineering’ are used interchangeably in the published literature.

**RQ2:** *How can service development terminology be standardised?*

## SEARCH METHOD

As previously discussed, services are sustainable in comparison to products, and there is a need to study how to develop and bring innovation into services. In the published literature, several different service development models and frameworks are found. A systematic literature review is performed in the present study to evaluate articles published in the period, 2000–2017, with the key focus being to identify models and frameworks for the development of new services. The literature review is limited to academic journals, books and conference proceedings.

A three-step search methodology is used to identify relevant articles and publications (see Figure 1). This methodology is identical to that of De Jong and Vermeulen (2003). In the first step, Google Scholar, Science Direct and relevant academic journal databases were searched, using the keywords (‘new service development’, ‘new service design’ and ‘service development models’). Further, the search results were screened on the basis of title and abstract relevance. Those titles and abstracts that were ambiguous and those that had passed the screening test were further evaluated in the third step, where the content of the article was analysed. The articles that reflected service development steps or a service innovation methodology were considered of primary importance. Through the screening mechanism shown in Figure 1, 26 articles were found to have significant information regarding service development and innovation. They are listed in Table 1 and are further discussed. Although there have been significant valuable studies, reflecting useful perspectives of service development, they are not included in the present study, since the knowledge regarding the development of new services was limited.

**Figure 1. Three-step search methodology**

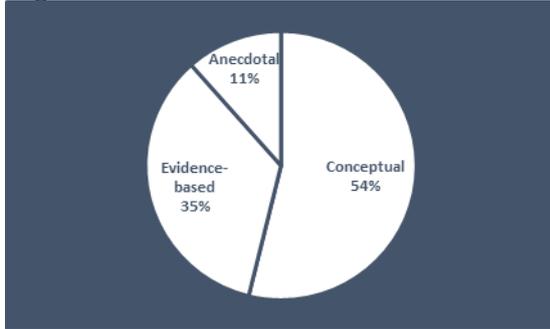
## RESULTS AND DISCUSSION

The published literature that passed the screening mechanism (see Figure 1) is compiled in Table 1. Firstly, the screened literature is characterised, based on the methodology of research work used in each of these studies. The types include conceptual, anecdotal and evidence-based studies. In the present case, a conceptual study is regarded as one in which the service development model is developed based on existing concepts, theories and inferences but testing of this model is not performed. An anecdotal study is one which is based on anecdotes or data collected through quantitative, qualitative or mixed-method sources that are not directly relevant. An evidence-based study is one in which the model or framework is developed either conceptually or anecdotally and tested and corrected based on the test results. The distribution percentage of the screened articles in each of these categories is shown in Figure 2. It can be seen that the majority of the service development models available in the published literature are of a conceptual nature. Anecdotal studies are fewer in number, since most of them are filtered out in the screening mechanism described in the previous section. This is because a large number of anecdotal studies emphasised only a few phases of the service development process and not the entire process, as well as being less relevant to the subject matter under study. Table 1 provides the researchers working in the field of service development with an overview of the research methodologies used in different studies.

**RQ<sub>3</sub>:** *What are the methods and ways for validating conceptual and anecdotal studies in service development?*

**Table 1. Different types of studies carried out for service development models**

Conceptual study	Anecdotal study	Evidence-based study
Johnson et al. (2000)	Neu and Brown (2005)	Alam and Perry (2002)
Manzini and Vezzoli (2003)	Jaw et al. (2010)	Blazevic et al. (2003)
Aurich et al. (2004)	Parasuraman (2010)	Olivia and Kallenberg (2003)
Perks and Riihela (2004)		Matthing et al. (2004)
Stevens and Dimitriadis (2004)		Hipp and Grupp (2005)
Verganti and Buganza (2005)		Aurich et al. (2006)
Lindahl et al. (2006)		Yang (2007)
Gottfridsson (2009)		Lee and Chen (2009)
Kindström and Kowalkowski (2009)		Zomerdijk and Voss (2010)
Den Hertog et al. (2010)		
Holopainen (2010)		
Clatworthy (2011)		
Jin et al. (2013)		
Teixeira et al. (2017)		

**Figure 2. Distribution of service development models listed in Table 1**

The service development models include conceptual models that present a process cycle, comprising of a sequence of steps that assist in the service development process, such as in the work of Johnson et al. (2000). They developed a new service development process cycle, which offers a concise model, presenting design, analysis, development and launch as the milestones of new service development, and further credit people, system and technology as the drivers to achieve successful development of new services. Conceptual models emphasising the product service system are also considered relevant. For example, Manzini and Vezzoli (2003) developed a framework which involves new stakeholders for a collective economic interest. The framework suggests a strategic design that implies that the business focus will be shifted from selling only physical products to jointly offering a system of products and services, together with other stakeholders, to fulfill clients' demands. Certain examples of product service integration are presented. In addition to the service development steps identified by Johnson et al. (2000), Manzini and Vezzoli (2003) also show the importance of including a sustainability plan in the service development process. Likewise, Aurich, Fuchs and DeVries (2004) present a generalised framework for service design and a concept evolving in the direction of product service systems. The framework suggests that the product and service design processes will be modularised into sub-steps and the overlapping features identified. The integration of overlapping features will result in new services and product service systems. The authors further suggest that quantifying the performance of the newly developed systems with the traditional product systems would serve as the assessment criteria for the newly developed system. The model presented by Aurich, Fuchs and DeVries (2004) sets the basis for product service systems. However, limited assistance is available in terms of developing new service ideas. These models are amongst the earliest chronological models and present service development steps, implications and aspects that can influence the process. However, these models are of a generalised nature and reflect no precise strategy for implementing them in different organisational settings. The process of service development would essentially differ between a manufacturing company and a software company. Therefore, there is a requirement to discover methods and techniques that can transform generic service development models for particular organisational settings.

**RQ4:** *How can generic service development models be transformed for a particular organisational setting?*

Conceptual models that also include customer engagement (other than conventional service development steps) are also present in the literature, such as Lindahl et al. (2006), who have highlighted the importance of customer involvement while designing service and have combined the customer dimension with the service development model. These authors have discovered an important service development benefit: customer engagement. However, these studies fail to provide customer engagement tools, for different types of customers and

organisational environments, that can help collect fruitful information at various stages of the service development process.

**RQ5:** *What are the methods for engaging and learning from customers at various stages of the service development process in different organisational environments? For example, Alam and Perry (2002) have given two suggestions: customer interviews and periodic meetings. How useful are these methods?*

Perks and Riihela (2004) and Stevens and Dimitriadis (2004) have conceptually developed models that reveal several parameters, which influence the nature of inter-functional activities and the outcomes of service design and combine organisational learning with new service development. Den Hertog, Van de Aa and De Jong (2010) have developed a comprehensive model for new service development and solutions. The model highlights dynamic capabilities, i.e., new service concepts, new customer interaction, new business partners, new revenue models and new delivery systems that can benefit organisations in their innovations and the development of new services. The authors believe that the successful service providers outperform their competitors within these capabilities and gain a competitive advantage. Holopainen (2010) has established service design architecture and applied it to a pragmatic study that explores how professional designers develop services. He discovered that service design has no optimised solution, and one layout from several possible solutions needs to be selected in order to proceed in the development process. Jin, Chai and Tan (2013) have found new service development success factors: strategy management, process formalisation, knowledge management, and customer involvement. It is theorised that a higher competence in grasping these processes positively influences the service development process. Correspondingly, Grenha Teixeira et al. (2017) have integrated management and interaction design used in organisations to develop a framework for service design. According to the authors, this interdisciplinary method enables the creation of innovative services and advances interdisciplinary service research. These models and frameworks have included organisational learning, dynamic capabilities, service architecture and interdisciplinary methods to advance service development. These parameters need to be studied simultaneously to select those that are vital, since it is impractical to focus on all these parameters in an organisation.

**RQ6:** *What are the criteria for selecting the vital parameters for service development models available in the published literature?*

Studies also include evidence-based conceptual models that have been successfully implemented in organisations. Alam and Perry (2002) determined new service development process stages and suggested that customer engagement can be achieved through interviews and meetings. Blazevic, Lievens and Klein (2003) discovered that a medium level of project learning is the ideal condition for service innovation. The authors highlighted the importance of the co-location of project knowledge and decision makers and discovered that the pressure of time-to-market has negative repercussions for innovation process. Oliva and Kallenberg (2003) studied how services could be integrated into products, the process for carrying out this integration and the challenges integral in the transition to services. Qualitative data from eleven different capital equipment manufacturers developing new services for their original products were investigated, and the findings reveal that a deliberate service development process is required in order to shift the customer market from products to services. The study further revealed that the shift from products to a service development process involved no technological difference but a different business model. Matthing, Sandén and Edvardsson (2004) experimentally proved that the information from a customer is much more valuable than that from a professional service designer; therefore, the service development model should collect feedback from the customers. Hipp and Grupp (2005) introduced a new topology to innovate in services, and their study revealed that the perspective regarding

innovation differs between the manufacturing sector and the service sector. Aurich, Fuchs and Wagenknecht (2006) developed a phase model that can assist develop technical services and integrate products and services. The model has been successfully implemented in an investment goods company. The model includes five phases: project study, concept development, service modelling, service testing and service adaptation. The phase model provides a brief overview of the major phases of the technical service development, along with the product. Yang (2007) developed a framework for an organisation's approach to service development in a parallel engineering environment. The framework comprises of several design stages that include process design, quality design, production-management design, capacity design, management design and technical design. These designs can be systematically implemented in a project to advance the performance of the new service. Lee and Chen (2009) revised a model to analyse the customer gap which reveals to managers the direction of service development. Zomerdijk and Voss (2010) presented six service design principles, which are derived from case studies of different organisations. Although these principles are not of a generalised nature, they can serve as a guideline for a number of organisations.

**RQ7:** *What are the different methods used to validate the service development models and how can they be improved?*

There are also service development models present in the published literature that are based on anecdotes. They include that of Neu and Brown (2005), in which the authors studied Fortune 500 companies and suggested a framework to successfully develop business-to-business services. According to the authors, external environment, strategy-environment fit, human resources, structure, measurement and rewards, and strategy formation are key for service development. Jaw, Lo and Lin (2010) developed a conceptual framework to understand the effect on new service development of four service characteristics, i.e., inseparability, heterogeneity, perishability and market orientation. The model is further used to examine different service firms in Taiwan. The results depict that heterogeneity, perishability and market orientation positively influence the advantage of service firms in comparison to physical goods. Parasuraman (2010) developed a service innovation framework by synthesising and extending the concepts from the existing literature relating to productivity, quality and innovation. The proposed framework concludes that service productivity, quality and innovation should be considered together while designing services. An isolated focus on these parameters results in suboptimal services. The framework suggested by the author addresses the importance of productivity, and quality and innovation assessed together in general. These studies show that the existing models have an emphasis on considerations that may influence service development. They highlight parameters that must be taken into consideration while developing service and which throw light on service design. However, there has been an under-focus on service idea generation in these studies.

**RQ8:** *How can innovative service ideas be established by organisations, startup companies and entrepreneurs?*

Through the literature review, it can be summarised that the larger number of service development models are of a conceptual nature, while a few are derived from anecdotes about successful organisations or qualitative data. The majority of the available models are for organisational settings and suggest recommendations to the managers and leaders to adapt strategies that may result in new service creation.

## **Orchestrating**

From the literature review, six major steps are identified in the service development process. These are planning, idea generation, business analysis, testing, launch and sustainability plan; see Table 2. The existing literature is unanimous as regards these steps; however, different

terminology is used in different articles to refer to these steps. It is also found that the existing literature readily provides guidelines for the planning, business analysis, testing and launch stages: see the corresponding articles listed in Table 2. However, idea generation and sustainability planning need further exploration. Discussions of these in the articles are significant, but practical guidelines that can be implemented in an organisational setting are lacking. For instance, Matthing, Sandén and Edvardsson (2004) experimentally proved that the ideas generated by customers are better than those of professional service developers, but a precise methodology to collect these ideas is not presented. Similarly, a sustainability plan is highlighted as a necessity for service development in several studies, but, in the service development models, practical approaches to implementing a sustainability plan show room for improvement.

**RQ<sub>9</sub>:** *How can innovative service ideas be established by organisations, startup companies and entrepreneurs?*

Analogous to the orchestrating of service development steps, seven service development actors are also identified. They are iterations in the service development process, technology, customer engagement and satisfaction, learning, information, communication, and stakeholders. These are identified as they are the most recursive actors that influence the service development process and there is substantial discussion of them in different publications: see Table 3. These actors play the key role while developing services: see the reference articles in Table 3. Generally, these actors influence managerial viewpoints, which give substantial assistance in service development. Technology is also considered an important actor, but few methods of developing technology-based services have been investigated. Grenha Teixeira et al. (2017) have recently attempted to combine management and technological aspects (interaction design) in service design, but further research into developing services from the newly developed technologies is vital.

**RQ<sub>10</sub>:** *How can technology-based services that integrate present and future technology trends be developed?*

From the published literature, it is evident that the service development literature lacks a generally accepted school of thought. The terminology, knowledge base and research methods are still in an embryonic stage. The orchestration of research established in the present study is of a generalised nature because of these challenges. A standardisation of terminology may assist in advancing the research work in a more thoughtful and organised way. Secondly, different researchers have developed this knowledge base based on the findings from their own locale. This has created a diverse knowledge base but one lacking coherence.

**Table 2 Service development steps in a nutshell**

<p><b>(i) Planning</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Manzini and Vezzoli (2003)</li> <li>• Aurich et al. (2004)</li> <li>• Aurich et al. (2006)</li> <li>• Lindahl et al. (2006)</li> <li>• Yang (2007)</li> <li>• Kindström and Kowalkowski (2009)</li> <li>• Teixeira et al. (2017)</li> </ul>	<p><b>(iii) Business analysis</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Aurich et al. (2004)</li> <li>• Perks and Riihela (2004)</li> <li>• Lindahl et al. (2006)</li> <li>• Yang (2007)</li> </ul>	<p><b>(v) Launch</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Aurich et al. (2004)</li> <li>• Lindahl et al. (2006)</li> <li>• Kindström and Kowalkowski (2009)</li> <li>• Holopainen (2010)</li> </ul>
<p><b>(ii) Idea generation</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Manzini and Vezzoli (2003)</li> <li>• Aurich et al. (2004)</li> <li>• Perks and Riihela (2004)</li> <li>• Aurich et al. (2006)</li> <li>• Lindahl et al. (2006)</li> <li>• Yang (2007)</li> <li>• Kindström and Kowalkowski (2009)</li> </ul>	<p><b>(iv) Testing</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Aurich et al. (2004)</li> <li>• Perks and Riihela (2004)</li> <li>• Aurich et al. (2006)</li> <li>• Lindahl et al. (2006)</li> <li>• Holopainen (2010)</li> <li>• Teixeira et al. (2017)</li> </ul>	<p><b>(vi) Sustainability plan</b></p> <ul style="list-style-type: none"> <li>• Manzini and Vezzoli (2003)</li> <li>• Verganti and Buganza (2005)</li> </ul>

**Table 3 Service development actors identified in the literature**

<b>Actors</b>	<b>Relevant literature</b>
<p><b>Iterations in service development process</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Perks and Riihela (2004)</li> <li>• Stevens and Dimitriadis (2004)</li> </ul> <p><b>Technology</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Neu and Brown (2005)</li> <li>• Verganti and Buganza (2005)</li> <li>• Aurich et al. (2006)</li> <li>• Den Hertog et al. (2010)</li> <li>• Jin et al. (2013)</li> </ul> <p><b>Customer engagement and satisfaction</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Alam and Perry (2002)</li> <li>• Olivia and Kallenberg (2003)</li> <li>• Aurich et al. (2004)</li> <li>• Matthing et al. (2004)</li> <li>• Hipp and Grupp (2005)</li> <li>• Verganti and Buganza (2005)</li> <li>• Lindahl et al. (2006)</li> <li>• Gottfridsson (2009)</li> <li>• Lee and Chen (2009)</li> <li>• Den Hertog et al. (2010)</li> <li>• Parasuraman (2010)</li> <li>• Zomerdijk and Voss (2010)</li> <li>• Clatworthy (2011)</li> <li>• Jin et al. (2013)</li> <li>• Teixeira et al. (2017)</li> </ul>	<p><b>Learning</b></p> <ul style="list-style-type: none"> <li>• Blazevic et al. (2003)</li> <li>• Matthing et al. (2004)</li> <li>• Stevens and Dimitriadis (2004)</li> <li>• Den Hertog et al. (2010)</li> <li>• Holopainen (2010)</li> <li>• Jin et al. (2013)</li> </ul> <p><b>Information</b></p> <ul style="list-style-type: none"> <li>• Blazevic et al. (2003)</li> <li>• Aurich et al. (2004)</li> <li>• Perks and Riihela (2004)</li> <li>• Stevens and Dimitriadis (2004)</li> <li>• Neu and Brown (2005)</li> <li>• Jin et al. (2013)</li> <li>• Teixeira et al. (2017)</li> </ul> <p><b>Communication</b></p> <ul style="list-style-type: none"> <li>• Blazevic et al. (2003)</li> <li>• Neu and Brown (2005)</li> <li>• Parasuraman (2010)</li> <li>• Jin et al. (2013)</li> </ul> <p><b>Stakeholders</b></p> <ul style="list-style-type: none"> <li>• Johnson et al. (2000)</li> <li>• Manzini and Vezzoli (2003)</li> <li>• Perks and Riihela (2004)</li> <li>• Stevens and Dimitriadis (2004)</li> <li>• Hipp and Grupp (2005)</li> <li>• Neu and Brown (2005)</li> </ul>

## CONCLUSION

It is concluded that conceptual, anecdotal and evidence-based methods are used in the published literature to develop service development models and frameworks. Conceptual models are greater in number as compared to their evidence-based and anecdotal counterparts. The mainstream published models address organisational issues and suggest recommendations for the managers and leaders to adapt strategies that may result in new service creation. It is also inferred that the service development stages agreed by most of the scholars comprise planning, idea generation, business analysis, testing, launch and sustainability plan, amongst which idea generation and sustainability planning have the potential to be improved. The study further reveals that there is scope for studying methods and techniques to develop technology-based services based on the newly developed technologies. The literature on service development is not systematic and lacks coherence. Studies standardising terminology and defining the research agenda are required so that a thoughtful knowledge base can be established. Also identified in the present study are ten research questions that have the potential for valuable future research.

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## PERSONALITY AS A PREDICTOR OF KNOWLEDGE-HIDING BEHAVIOUR: CASE STUDY OF ALPHA ELECTRONICS

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### ABSTRACT

Employees' knowledge-hiding behaviours can be detrimental to employees' interpersonal relationships and to individual and organisational learning and creativity. However, not everyone who hides knowledge hides it the same way; as individuals are different, so are their behaviours. This study explores the links between employees' personality traits and their knowledge-hiding behaviours. By using a single case study as a research methodology and collecting data through 28 semi-structured interviews, we foreground the patterns of relationships between employees' personality traits and knowledge-hiding behaviours, which are: rationalised hiding, evasive hiding and playing dumb. Our findings suggest that extroverts involve in evasive knowledge hiding; while introverts demonstrate rationalised hiding. Moreover, both extrovert and introvert employees engage in playing dumb in situations that involve risk for their jobs and careers. Besides theoretical contributions, the study offers important implications for organisations faced with the challenges of shortage of skills and knowledge.

**Keywords:** Knowledge hiding, Personality, Rationalised hiding, Playing dumb, Evasive hiding.

### INTRODUCTION

Employees' knowledge-hiding behaviour (a deliberate effort to conceal or withhold knowledge that others have asked for (Connelly and Zweig, 2015)) can be detrimental for an organisation in several ways. Knowledge-hiding behaviours can lead to delays in decision-making, create a culture of distrust, harm employees' interpersonal relationships and impede knowledge sharing, organisational learning and innovation (Connelly et al., 2012; Connelly and Zweig, 2015; Ford and Staples, 2010). Connelly et al. (2012) suggest that employees can demonstrate three types of knowledge-hiding behaviours: rationalised hiding, evasive hiding and playing dumb. Rationalised hiding refers to knowledge-hiding behaviour where the hider gives a justification for why knowledge is not forthcoming by either suggesting that (s)he is unable to provide the requested knowledge or putting blame on someone else. Evasive hiding refers to knowledge-hiding behaviour where the hider provides incorrect or incomplete information or a false promise of providing information in the future. Playing dumb refers to knowledge-hiding behaviour where the hider pretends not to have the requested knowledge.

Globalisation and advancement in information technology have blurred the boundaries of jobs, organisations and nations. The changing nature of the workplace and work and increasing interdependence requires more focus on teamwork and close collaboration among employees. However, team members' knowledge-hiding behaviour can harm the relational dynamics and performance of the team (Peng, 2013) and hamper managers' endeavours to achieve organisational objectives and gain competitive advantage (Connelly and Zweig, 2015; Ford and Staples, 2010). Knowledge hiding can worsen the situation for firms from emerging economies, as due to economic and trade reforms of varying magnitude, emerging economies have witnessed an influx of multinational

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companies from developed countries (MNCs henceforth), but there is an obvious gap of skills, resources, technology, knowledge and capabilities between the developed countries' MNCs and the emerging economy firms (Wright et al., 2005; Pérez-Nordtvedt, Babakus and Kedia, 2010; Chittoor, Aulakh and Ray, 2015). Consequently, the emerging economy firms face serious challenges in competing with the MNCs and responding to competitive pressure (Zou and Cavusgil, 2002). Employees' knowledge-hiding behaviours can impede the pace of learning and can further deteriorate firms' ability to respond to the competitive pressure.

However, not everyone who hides knowledge hides it the same way; as individuals are different, so are their behaviours. The quest for exploring the dynamics of individual differences is centuries old and can be traced back to the Greek Philosophers in the fourth century BC (Wright, 1983). Personality psychology is one of the ways to study individual differences. Personality has been defined in a variety of ways: Wright et al. (1970, p. 511) defined personality as "the relatively stable and enduring aspects of individuals which distinguish them from other people and form the basis of our predictions concerning their future behaviour". Therefore, we argue that depending on the personality traits, different individuals can demonstrate different knowledge-hiding behaviours. By understanding knowledge hiding and its antecedents, managers can endeavour to overcome such behaviours that can constrain organisational learning and development. However, despite the significant destructive influences of employees' knowledge-hiding behaviours on organisations and the obvious links between employees' personality traits and their knowledge-hiding behaviours, literature on the relationship between employees' personality traits and knowledge-hiding behaviours is scarce. Indeed, the researchers have brought to the fore several antecedents and consequences of employees' knowledge-hiding behaviours in the organisational context (e.g. Connelly and Zweig, 2015; Černe et al., 2014; Peng, 2013; Connelly et al., 2014; Bogilović, Černe, and Škerlavaj, 2017). However, a recent call (Connelly et al., 2017) rightly highlights that the literature on the contingencies, antecedents and outcomes of employees' knowledge-hiding behaviours is still in its infancy.

To contribute to filling these gaps in the literature, this study explores the links between employees' personality traits and their knowledge-hiding behaviours. By using a single case study as a research methodology and collecting data through 28 semi-structured interviews from employees working in Alpha Electronics (a pseudonym for the company to maintain anonymity) operating in Pakistan, we foreground the patterns of relationships between employees' personality traits and knowledge-hiding behaviours: rationalised hiding, evasive hiding and playing dumb. The contribution is imperative given the potential destructive influences of employees' knowledge-hiding behaviours on organisational learning, innovation and manager's endeavours to gain competitive advantage as well as the dearth of research on the antecedents and outcomes of knowledge hiding.

Other than theoretical contributions, our study provides important managerial implications. The study suggests that if managers appropriately manage personality diversity, they can discourage knowledge-hiding behaviours and can overcome hindrances relevant to such destructive employee behaviours in team learning and performance. Moreover, understanding employees' personality differences, managers can improve team learning and performance, as the personality has more direct and powerful effects on group processes than other group composition variables (Moynihan and Peterson, 2001). Moreover, we propose that managers can intervene through different strategies such as linking rewards and providing training to inspire employees to share knowledge and demonstrate more prosocial behaviours that are constructive for other employees' learning and development to help organisations build competencies and improve the quality of their products, services and organisational practices. An important potential implication relates to employee selection process, where personality assessment results can be used to predict future knowledge-hiding

behaviour. Our findings can be helpful for organisations particularly from emerging economies faced with the challenges relevant to the shortage of skills and knowledge, as discouraging knowledge-hiding behaviours can improve employees' development and learning and enhance the pace of organisational learning.

## **PERSONALITY AND KNOWLEDGE HIDING**

Knowledge hiding is not the opposite end of the knowledge sharing continuum; in other words, the absence of knowledge sharing does not mean the presence of knowledge hiding. Rather these two are conceptually distinct constructs (Connelly et al., 2012; Ford and Staples, 2010). Knowledge hiding is an intentional concealment of knowledge that has been requested by another individual. The motivations behind knowledge hiding and the lack of knowledge sharing differ from each other. Lack of knowledge sharing is not an intentional effort to conceal the knowledge; the reason behind lack of sharing might likely to be the lack of knowledge. On the contrary, knowledge hiding does not include situations where individuals fail to provide knowledge due to being ignorant or by mistake (Connelly et al., 2012).

Some other authors use the term “knowledge withholding” to refer to knowledge hiding behaviour. For example, knowledge withholding is defined by Lin and Wang (2012) as concealing knowledge that is valuable and important for others. The behaviour of knowledge withholding has also been addressed as a form of social undermining at work by Duffy, Ganster, and Pagon (2002); i.e. an individual may engage in active or passive undermining behaviour at work by withholding the needed knowledge, making ridiculous comments and giving ‘silent treatment’ to others. The seminal authors of the concept, Connelly et al. (2012), suggest that only active and intentional attempts to conceal knowledge are included in the definition of knowledge hiding.

The scarce literature of knowledge hiding highlights different motives for hiding knowledge. For example, Connelly et al. (2012) found the positive relationship between the complexity of knowledge and knowledge-hiding behaviour. That is, the more complex the requested piece of knowledge is, the more likely the employee would be engaged in knowledge hiding. The same study also discussed interpersonal dynamics between hider and seeker and empirically tested the positive relationship between distrust and knowledge-hiding behaviour. To further learn the effects of distrust in relation to knowledge-hiding consequences, Černe et al. (2014) studied the interpersonal distrust loop to illustrate the relationship between creativity and knowledge hiding. Drawing on social exchange theory, they concluded that the knowledge hidiers end up hurting their own creativity because of concealing knowledge from their co-workers.

Individuals have their own unique personality and their personality is exhibited through their beliefs, attitudes and behaviours. Personality is the visible aspect of someone's character i.e. how individuals present themselves to others in various social situations. Peng (2013) added the aspect of individuals' personal attributes to the knowledge-hiding literature by studying the effects of knowledge-based psychological ownership on knowledge-hiding behaviour. He encourages us to study the effects of other individual variables like conscientiousness, one of the ‘Big Five’ personality traits, on the relationship between territoriality and knowledge hiding. Serenko and Bontis (2016) also look forward to spotting the influences of personality or gender on the dyadic relationship between two individuals who choose to share or hide knowledge from each other.

Individual differences as dispositional factors may help to find the patterns of knowledge-hiding behaviours in relation to employees' specific personality traits, which would enable the researchers to study these effects on the relationships between knowledge hiding and other antecedents: interpersonal dynamics between the hider and the seeker as studied by Connelly et al. (2012) and Černe et al. (2014) and knowledge-based psychological

ownership as studied by Peng (2013). Thus, exploring employees' knowledge-hiding behaviours in relation to the individuals' personality traits is important to advance the research in this domain.

Personality literature presents many theoretical approaches and the 'Trait Approach' is one of them. Further, the Big Five (Five Factors Model) of personality (John, Naumann, and Soto, 2008; McCrae and Costa, 2008) is one of the widely-used personality traits models. It suggests five personality dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (McCrae and John, 1992). In this study, we explored the relation of knowledge-hiding behaviour with only one personality dimension: extraversion. Extraversion has two ends of the spectrum; the people with high scores on this scale are extroverts while the people with low scores are introverts. Hence, our research question is "how does the personality trait extraversion influence the manifestation of individuals' knowledge-hiding behaviour?".

## RESEARCH METHODOLOGY

A single case study was used as a research methodology, as it facilitates in-depth exploration of the understudy social phenomena (Yin, 1994). The study employed a qualitative approach to gain insights into the relation between personality and three facets of knowledge-hiding behaviour. As the domain of knowledge hiding is still growing and dispositional influences on knowledge hiding remain largely unexplored, we carried out a qualitative research study to gain insights into the relation between personality trait (extraversion) and three facets of knowledge-hiding behaviour.

## DATA COLLECTION AND ANALYSIS

28 semi-structured interviews were conducted with the employees and managers working at different levels in Alpha Electronics, an electronic products manufacturing company operating in Lahore, Pakistan. The participation in the study was voluntary and the interviewees signed consent forms. The average duration of the interviews was almost 90 minutes. The interviewees consisted of 15 males and 13 females with the work experience ranging between 2 and 15 years. The interviews were audiotaped and transcribed verbatim. To ensure anonymity, the interviewees were coded as E1, E2, E3, and so on. Thematic analysis was used for analysis and interpretation of audiotaped data collected during semi-structured interviews. The thematic analysis identifies, analyses and records patterns (themes) within the data. Based on the key themes that emerged from the data, the respondents were categorised as extroverts and introverts. Then we identified different knowledge-hiding behaviours from the data. Finally, we compared extroverts and introverts with the knowledge hiding behaviours to create links between personality and knowledge-hiding behaviours.

The key themes relevant to extraversion, introversion, and knowledge hiding that emerged from our data are presented in Table 1 along with their respective codes and some supporting quotations.

**Table 1. Themes, codes and quotes**

Themes	Codes	Quotes
Extraversion	Sociable	<p>"I enjoy social gatherings like family function, children events, workplace events and various other events, not one in particular." (E1)</p> <p>"Yes I am very social and like to interact with different kinds of people." (E22)</p> <p>"Absolutely, I enjoy social, official, personal, family and recreational gatherings." (E15)</p>
	Enjoy being	"I would feel good If I become center of attention in any

	center of attention	social gathering.” (E1) “You know I like people notice my presence. I like people giving attention to me”. (E15) “Social gathering should all be about me and my presence”. (E14)
	Talkative	“I am very talkative.” (E11) “Yes I am very talkative.” (E21)
	Comfortable in talking to strangers	“I generally get comfortable with strangers easily and quickly.” (E5) “I always feel comfortable talking to unknown people very quickly.” (E9) “I take some time to observe people and then start conversation to the ones I feel I can talk to.” (E14)
	Prefer working in team	“I would prefer working in a team rather than working alone.” (E10) “I already do work with teams and I really enjoy it.” (E15) “I like to do interactive tasks and would opt for it.” (E17)
	Resolve conflicts actively	“In case of conflict with a colleague, I play an active role to pursue the matter and try to resolve it in good manner.” (E10) “In case of conflict, I tend to take active part for resolving the issue.” (E17)
Introversion	Less sociable	“I like meeting with friends specially when I see them after long and it feels nice. Otherwise, I don’t enjoy social gatherings where there are strangers and I get bored.” (E3) “I only enjoy meeting with people I really like. Otherwise I am somewhat reserved.” (E4)
	Uncomfortable being center of attention	“I would blush if I find myself as center of attention in any social gathering.” (E18) “I usually stay away. I do not want to or try to gain attention”. (E23)
	Less talkative	“I don’t talk much. Generally people perceive that I am a reserved kind of person who talks less.” (E23) “I am not that talkative. I usually keep silent and give my opinion on matters if I am asked to do so”. (E3)
	Do not initiate conversation with strangers	“I will remain a silent observer among strangers and will only talk when I am asked something. I won’t initiate discussion.” (E13) “I prefer to observe. I often won’t take initiatives” (E4)
	Prefer working alone or in one-on-one	“I would like to choose tasks which are more challenging. But if tasks are same, I’ll prefer working alone.” (E6) “I prefer working in small groups or on tasks involving one-on-one interaction.” (E27)
	Resolve conflict passively	“In case of conflict with a colleague, I try to step back and don’t take initiative to resolve it. I tend to think that the matter will be resolved later.” (E26)

		“In case of conflict, I would give space to other person, will just sleep over it for some time and then will communicate.” (E12)
Knowledge hiding	Rationalised Hiding	“I told the person requesting access to a dataset resource that I am still experimenting with it and my work is under process. That’s why I can’t share it with him.” (E3) “If the information is confidential then I would straightaway say that I can’t disclose it.” (E12) “I don’t do delaying tactics either I provide information or I refuse straightaway. I don’t keep anyone in the intermediate state.” (E18)
	Evasive Hiding	“I use delaying tactics by saying that I don’t get your question and then provide incomplete information or provide information in a way that makes it difficult to extract the exact information he required.” (E1) “If I don’t want to share some knowledge, I try not to refuse it straight but to handle the situation tactfully.” (E5) “If any of my colleagues demands confidential information, I don’t refuse straight forwardly. I handle it tactfully.” (E21) “I didn’t convey the reason explicitly but I gave her indirect cue that I was not happy with her behaviour.” (E17)
	Playing Dumb	“Usually, I pretend as if I don’t have any information to avoid such requests.” (E21) “As he was my senior, I had to hide the fact that I had the material with me which I didn’t want to share.” (E4)

## FINDINGS

### Extraversion

Extraversion is one of the five main traits of the Big Five personality theory. A person who is extrovert is the life of the party, talks frequently with people, enjoys gatherings, is highly sociable and is friends to all. The following codes were used to highlight different aspects of respondents’ personality on extraversion trait (respective quotations are presented in Table 1).

### *Sociable*

Sociable people usually are people for parties and fun. They like to be in contact with different people and also like to make many friends. The statements of the participants depict that the participants like to attend parties, enjoy social gatherings and like to interact with different kinds of people.

### *Enjoy being centre of attention*

Extroverts like to be adored and enjoy being the centre of attention in any gathering, be it professional or casual. The quotes show that extroverts do not shy away from public attention. Rather, they like and enjoy being a central figure in any gathering.

### *Talkative*

People who talk more and tend to chat on different topics and enjoy communication are usually referred to as extroverts. The respective quotes strengthen this idea.

***Comfortable talking to strangers***

Besides friends, family or acquaintances, extroverts also find it rather easy to get into discussion with a stranger and feel no reluctance in doing so. The quotations validate the idea that extroverts find it comfortable and easy to talk with people they are not familiar with.

***Prefer working in a team***

The people who like to work in teams or groups are most likely to be extroverts than the people who tend to work individually to achieve a task. The responses suggest that they prefer to work in collaboration with other people as a team.

***Resolve conflicts actively***

In case of conflicts between people, extroverts tend to resolve the issues by actively taking steps or contributing to the resolution. The respondents, when asked about their response in the case of a conflict, indicate that they try to play an active part to resolve an issue.

**Introversion**

Introversion is the opposite end of the extraversion trait. Introverts are less talkative, feel indifferent towards social activities, feel uncomfortable when they find themselves in the centre of social attention, and feel less lively and optimistic than others do. The following codes were used to highlight different aspects of respondents' personality on low extraversion (respective quotations are presented in Table 1).

***Less sociable***

Introverts do not like much gatherings and keep their friend circle to a few people and like to meet only those people whom they know already and are comfortable with. The quotes also show that frequent public gatherings make them bored because they are usually reserved by nature.

***Uncomfortable being centre of attention***

Introverts usually do not have the desire to stand in the limelight; they feel uncomfortable and do not enjoy if they become the centre of attention in any public gathering. The quotes show that the respondents would be shy and would not be much at ease if they are the centre of attention in social meetups.

***Less talkative***

People who tend to talk less do not seem to express themselves very explicitly; they don't really like to make small talk or gossip. Less talkative people mostly fall in introvert personality type.

***Do not initiate conversation with strangers***

The people who feel uncomfortable in the company of people whom they do not know also tend to remain somewhat quiet and try not to start a conversation with strange people. The quotes suggest that they would like to observe people whom they do not know rather than getting into active interaction with them until they are explicitly asked to do so.

***Prefer working alone or in one-on-one***

To accomplish a task or complete a job, introverts tend to work by themselves or with fewer people, rather than working with big teams and groups of people. The quotes suggest that they have a tendency to work either alone or with least people to achieve goals. Unless the task is too challenging to be completed alone, they prefer working individually.

***Resolve conflicts passively***

Most of the times, in case of an issue or conflict between coworkers, introverts react passively. The respective quotes indicate that in case of any conflict with their colleagues, they will not take the initial steps to resolve the matter; rather they will step back and think over the issue and then may communicate or let it get resolved later.

### **Knowledge hiding**

We found three manifestations of knowledge-hiding behaviours.

#### ***Rationalised hiding***

Rationalised hiding behaviour is exhibited when the hider withholds knowledge by giving a specific reason(s) or rationale behind his/her behaviour, by blaming others to justify his/her inability to fulfill the request, or by responding with plain 'no'. The quotes in Table 1 show that respondents high on the introversion manifest rationalised hiding behaviours by giving the reason behind their inability to provide requested knowledge. They also hide knowledge with the plain 'no' and do not want to keep the requesting person in any doubt. In sum, introverts demonstrate rationalised knowledge hiding.

#### ***Evasive hiding***

Evasive hiding behaviour is exhibited when the hider, upon request to share some knowledge, agreed to help but never really intended to, provided some part of that knowledge and kept the rest of it to himself, supplied different information than was requested, or used delaying tactics. As shown in Table 1, that the extroverts, upon being asked about knowledge they do not wish to share, tend to handle the request tactfully and do not explicitly state their intention of not sharing knowledge. They exhibit evasive hiding behaviours either by sharing incomplete information or by using delaying tactics to carefully handle the situation.

#### ***Playing dumb***

Playing dumb behaviour is exhibited when the hider, upon being asked for some knowledge, pretends that (s)he does not possess such information at all even when (s)he has that knowledge, or simply by pretending that (s)he doesn't know what the other is talking about. The findings suggest that, in some specific situations such as when they feel that evasive and rationalised hiding carry some risk, both extroverts and introverts tend to play dumb.

## **DISCUSSION AND CONCLUSION**

Our study explored the relationship between personality and knowledge-hiding behaviours. For this purpose, we used a single case study of Alpha Electronics, collected data through 28 semi-structured interviews and analysed data using thematic analysis. The data we collected revealed some interesting patterns between personality and knowledge-hiding behaviours. By analysing the data, we found that 60% of our respondents represented the personality characteristics usually affixed to extroverts. They not only enjoy being part of various social gatherings, but also enjoy being the centre of attention in such gatherings. Our respondents on the higher end of extraversion are generally talkative and can easily initiate conversation with strangers. Almost all such respondents acknowledged that they make the first move to start conversation with unknown people whenever they have to stay in a situation surrounded by many strangers like, sitting in waiting rooms, during long travels, etc. Furthermore, the extroverts prefer to work in teams rather than working alone; they feel themselves more energetic while working in a collaborative group setting. Another common attribute we found in our extrovert respondents is their active role in conflict handling; most of them recounted experiences in which they actively played their part in conflict resolution by bridging the communication gap. Even, some of them explained how they volunteered for the role of mediator in resolving conflicts between their teammates.

The rest (40%) of respondents demonstrate the personality characteristics usually affixed with the low end of extraversion, i.e., introversion. They showed less sociable tendencies; they only like to meet with their friends and likeminded people one-on-one or in small gatherings instead of large get-togethers. Some of them disclosed that they only join social gatherings when they feel compelled to do so. They do not like being the centre of attention and try to avoid such situations. They usually are less talkative and do not initiate conversation. When they have to stay at a place surrounded by many strangers, like in waiting rooms, during long travel, or any networking event, they usually like to read some book or newspaper, listen to others and observe things around them instead of being an active part of conversation. The majority of introverts in our study prefer working independently instead of working in a group; and a few of them added that they do like to work in a one-on-one communication situation instead of working in large groups.

Extroverts did not present even a single situation, in which they ever exhibited rationalised hiding. Most of their responses revealed that extroverts are more likely to hide their knowledge in indirect way, i.e., evasive hiding. The sociable nature of extroverts explains the reason behind not responding with plain 'no'. In order to maintain their good social relations at workplace, they tend to handle the situation tactfully when they neither want to give information or lose good relations with their colleagues. Along the same lines, introverts did not present any situation in which they ever exhibited evasive hiding. All of their responses revealed that introverts are more likely to exhibit rationalised hiding behaviour whenever they were exposed to the situations where they wanted to withhold information. Again, their self-centered nature explains such behaviour.

Only a few of our respondents (both extroverts and introverts) revealed 'playing dumb' behaviour. By carefully examining the statements of those respondents, we came to know that the situations in which they exhibited 'playing dumb' behaviour was one where they had to respond to a knowledge-seeking request from their senior colleagues, particularly their managers. Thus, we uncovered that when people realise the drastic consequences of providing misleading or incomplete information, they tend to play dumb instead of using evasive or rationalised hiding as in such cases, evasive and rationalised hiding could be harmful to their job and career-related interests and motives. Conclusively, the findings of our research study show that the individual differences can explain various knowledge-hiding behaviours at workplace.

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