Verifying e-Government Market Segments

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Abstract: This paper reinforces earlier work by statistically validating the measurement dimensions of a new e-Government service market segmentation. The paper shows that the dimensions are necessary and sufficient for describing the segments. It also shows that when applied post-hoc to financial transactions, the segmentation reveals the behaviours of four independent statistical populations, reinforcing the claims of the validity of the segmentation. The paper concludes that the segmentation is valid and points to future research.

Keywords: e-Government, market segmentation, service design, service adoption

1. Introduction

This paper provides further evidence for the appropriateness of a refined segmentation of 'Citizen'-oriented e-government services developed in earlier work (Turner, 2002; Turner & Schwager, 2005; Turner, Schwager & Imran, 2005). The intention behind the segmentation is to partition the problem of how to design, develop and deploy effective e-government services into narrower focus areas. If e-government services are aimed at making interactions with government easier, faster and more convenient, the proposed segmentation will enhance the design of services to this end by helping to organise, analyse, and manipulate ideas, designs and data more efficiently. Identifying market segments is expected to reveal groups of users for whom adoption and use of e-government services is high, and other groups where it is low (Barker, 1985; Changchien, Leeb & Hsu, 2004; Engel, Fiorillo & Cayley, 1972; Forsyth, Lavoie & McGuire, 2000; Kim, Nam & Stimpert, 2005; Peltier & Schribrowsky, 1997; Pires & Aisbet, 2003; Ryan, 1991; Wedel, 2001). This additional understanding of narrower, more homogeneous market segments is expected to aid e-government service developers to pick services where quick wins might reasonably be expected and to avoid complicated web-based delivery projects for groups where adoption and use is low (Changchien, Leeb & Hsu, 2004; Engel, Fiorillo & Cayley, 1972; Forsyth, Lavoie & McGuire, 2000; Kim, Nam & Stimpert, 2005; Peltier & Schribrowsky, 1997; Pires & Aisbet, 2003; Ryan, 1991; Spratlen, 1981; Wedel, 2001). This is a simple extension of the idea already practiced that separates 'Citizen' services from, say, 'Business' and 'Government'-related services.

It is commonly held that government serves four broad constituencies: citizens, businesses, other governments, and employees (Central IT Unit, 2000; Deloitte Research, 2000; Government of Canada, 2002; Jackson & Curthoys, 2001; Jupp & Shine, 2001; McClure, 2000). We have refined this market segmentation in the 'Citizen' constituency, which is regularly referred to by a variety of names: citizens, customers, clients, the public, etc. Sometimes, these titles are used interchangeably, for example: "The emancipated citizen is a highly demanding client, who wishes to be treated in a customer-friendly way" (Lapre & van Venrooij, 2001); but they should not be (Mintzberg, 1996; Scholl, 2001). This paper defines and uses these terms more precisely.

The refined segmentation, adopted from the work of Henry Mintzberg (1996) rather than being developed through more classical segmentation approaches (Haley, 1981; Johnson, 1981; Roberto, 1991; Smith, 1972), classifies e-government service recipients into four groups: *customer*, *client*, *subject* and *citizen*; summarised here in Figure 1. Earlier work (Turner, 2002) noted that the segmentation was applicable to all government services, online or not. The potential benefits of adopting such a segmentation approach when designing e-government services were also discussed.

Segment	*Brief description*
Customer	Customers are those constituents of government that purchase commodities from government agencies; for example, utilities, lottery tickets, etc
Client	Clients are constituents that purchase or receive professional services from government over a period of time, possibly over their whole lifetime; for example, health services, education, job location services, etc
Citizen	Citizens are constituents that receive services from the government at a broad level; for example the provision of infrastructure such as sewerage, roads, air traffic control, etc
Subject	Subjects are constituents that receive mandatory service from government, without the opportunity to influence the parameters of service provision; for example, prison inmates, tax payers, and national service conscripts

Figure 1: Summary of 'Citizen' Segmentation (Turner, 2002)

Recent research has developed this idea further. We have previously noted (Turner, Schwager & Imran, 2005) that the segments adopted from Mintzberg (1996) constitute a 'benefits' segmentation (Rossiter, 1985). "The belief underlying this segmentation strategy is that the benefits which people are seeking in consuming a given product are the basic reasons for the existence of true market segments" (Haley, 1981, p309). Mintzberg specifically establishes that the view of government from each of his roles is different; that an individual acting in that role will expect very different outcomes and behaviours from government (Mintzberg, 1996). These outcomes and behaviours are 'benefits' of government service (in a benefits segmentation sense) (Dubow, 1992; Haley, 1981).

In Turner, Schwager and Imran (2005), the requirements of appropriate market segments were reviewed. The proposed segmentation was found to meet the six mandatory requirements of good market segmentation (Barker, 1985; Engel, Fiorillo & Cayley, 1972; Kotrba, 1972; Roberto, 1991):

- "Mutual Exclusivity—each segment should be completely separate from all other segments;
- Exhaustiveness—every potential target adopter should be included in some segment;
- Measurability—each segment's size and profile should be measurable;
- Accessibility—each segment should be capable of being effectively reached and served;
- Sustainability—each segment should be large enough to be worth pursuing independently of other segments; and
- Differential Responsiveness—each segment should respond differently and not exactly like other segments with respect to different marketing inputs and mixes" (Roberto, 1991, p82).

As described in Turner, Schwager and Imran (2005), in this benefits segmentation, segments are based on the type of service to access and the relative priorities for different services (Haley, 1981; Spratlen, 1981). Measurability is therefore a matter of how we identify the nature of services that makes them beneficial to different constituent groups. Members of each segment must be identifiable through the measurement of some characteristic(s) (Bhatnagar & Ghose, 2004; Bloom & Novelli, 1981; Engel, Fiorillo & Cayley, 1972; Peltier & Schribrowsky, 1997; Pires & Aisbet, 2003; Rossiter, 1985). Obvious and frequently-used examples are characteristics such as demographics, or (social) values (Rossiter, 1985). More potent measures in a commercial environment are previous buying behaviour, brand awareness and brand attitude (Bhatnagar & Ghose, 2004; Bloom & Novelli, 1981; Changchien, Leeb & Hsu, 2004; Hütt, Le Brun & Mannhardt, 2001; Rossiter, 1985; Ryan, 1991). In benefits segmentation, the definition of benefits involves a combination of factors that complicates measurement (Haley, 1981; Peltier & Schribrowsky, 1997). Similarly, the requirements of government to meet the needs of all constituents can blur measurement dimensions (Bloom & Novelli, 1981; Ryan, 1991).

We categorise constituents into segments through the lens of their intent as they seek to and do access the service in line with Mintzberg's (1996) original proposition. This approach does not lend itself well to 'scientific', quantitative measurement. However, the purpose of the segmentation is not for conducting empirical research to prove hypotheses but to frame advice on how to account for the needs of members of each segment.

Despite the difficulty of applying quantitative measures to this benefits segmentation, we proposed that these segments have certain transactional characteristics and that existing services can be segmented on the basis of these characteristics (Turner, Schwager & Imran, 2005):

- Interaction complexity—whether a meaningful transaction between the government and the constituent can be completed in a single, multiple or repetitive interactions.
- Service differentiation—the extent to which each transaction is tailored to the personal/unique circumstances of the constituent.
- Reliance on Government—whether or not the transaction requires the government as a participant or might occur between the recipient and some non-government entity.

Figure 2 indicates how the different characteristics combine to identify the proposed segments.

	Interactions		***Differentiation***		***Reliance on Government***	
Segment	***Single***	***Multiple/ Repetitive***	***Commodity/ 'Menu'***	***Individually Tailored***	***None***	***Complete***
Customer	*Don't care*					
Client	*Don't care*					
Subject			*Don't care*			
Citizen			*Don't care*			

Figure 2: Segment Characteristics on Three Dimensions (All possible combinations) (Turner, Schwager & Imran, 2005)

Some data on e-government services were provided to us for exploratory research by the Australian Capital Territory (ACT) Government. The ACT Government kindly provided summary results of all financial transactions conducted by the government over the period mid-2000 to end-2004. The data provided the number of transactions and the total value of each type of financial transaction conducted by the government for each month during that period. The data were also classified by the channel through which the transaction took place (over-the-counter, telephone, Internet, etc).

In Turner and Schwager (2005), we showed that the segments as defined exhibited different behaviours when the ACT data were analysed on the basis of our segment measurement dimensions. This important differential responsiveness is critical to the usefulness of the segmentation (Changchien, Leeb & Hsu, 2004; Claycamp & Massy, 1972; Forsyth, Lavoie & McGuire, 2000; Kotrba, 1972; Peltier & Schribrowsky, 1997; Rossiter, 1985; Smith, 1972). If the segments do not respond differently, they are not useful as segments.

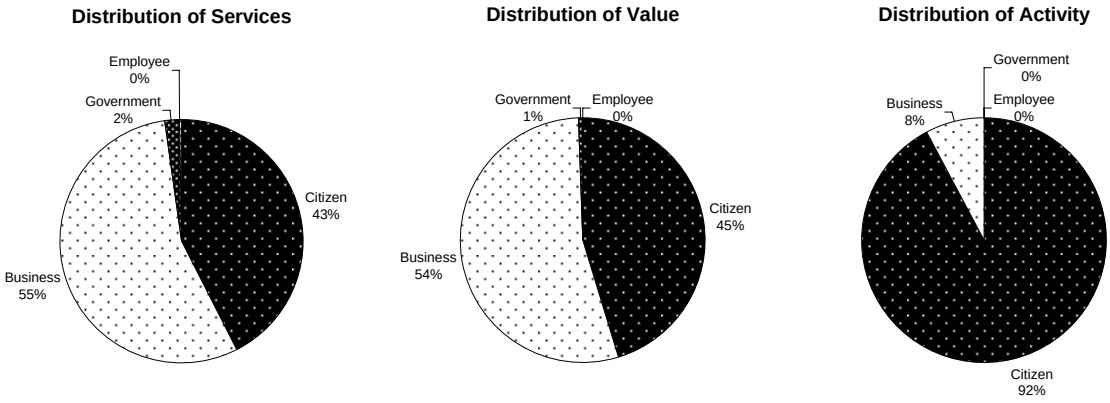
In this paper, our aim is to apply some simple statistical tests to the segment measurement dimensions and the initial analysis to support our claims of rigour for the segmentation even if applied post-hoc. Note that we are not trying to prove the segments in some fundamental sense, nor is our intent to divine the true nature of the segments from the evidence of them in the data. Our intent here is only to show that our assertion of exclusivity and differential responsiveness is reflected by data that show statistical independence when considered through the lens of the segmentation. We will test the necessity and sufficiency of the measurement dimensions and the independence of the data results when analysed in those dimensions. The paper concludes with assertions about the application of the segments ante-hoc and the projection of further work.

2. Creating Segments

The financial transaction data were classified by ledger account codes. To segment the services represented by the transactions, we considered the short description of each account code in the

context of the agency that owned that code and marked the code as one of the four broad segments ('Citizen', 'Business', 'Government', 'Employee') or Internal (for journal-like entries and other miscellaneous financial transactions). Codes were analysed on the basis of the textual content of their description. Many codes were found for obvious 'Citizen' transactions (e.g. "Drivers' Licence Fees", or "Library Fines") and for 'Business' transactions (e.g. "Motor Vehicle Dealers' licence", "Liquor Permit"). A few codes were found relating to inter-governmental transactions (e.g. "Deposit to Subscription (Government)", "Commonwealth Tax Equivalent"). A couple of codes were found that related to 'Employee' transactions (e.g. "Shopfront Uniform Sales"). We validated our views on this segmentation with our contacts in ACT Government and they made some small changes to correct our misunderstandings.

Figure 3 shows the segmentation results from this first step (Number of 'Services' [n] = 277). The nature of the account data allows us to consider the effect of the segmentation in three areas: the number of transaction types (i.e. unique codes, equivalent to 'services' for our purposes) allocated to each segment (Figure 3 (a)), the total value of all transactions allocated to that segment (Figure 3 (b)), and the number of actual transactions (activity) conducted by each segment (Figure 3 (c)).

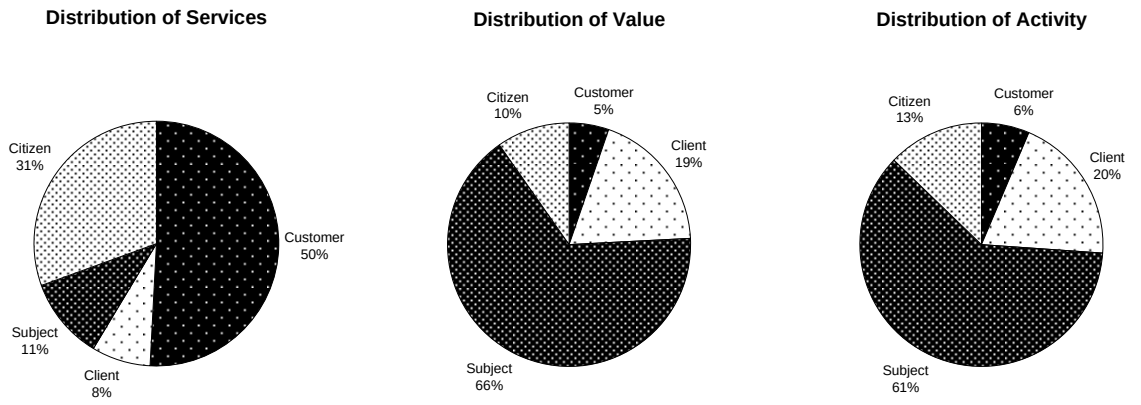


(a) (b) (c)

Figure 3: Distribution of Financial Transactions over 'Broad' Segments (from project data)

The codification of transactions by researchers in this way is seen as 'noiseless'. As we negotiated a consensus view on all transactions, and validated them with ACT Government 'experts', each transaction is certainly within the segment assigned; that is, there are no 'shades of grey' and the data created are at the 'nominal' level (Conover, 1971; Sarantakos, 1998; Selvanathan et al., 1994).

Accepting, then, that we have partitioned the 'services' offered by the ACT Government along 'classical' segment lines satisfactorily, we can narrow our focus to the broad 'Citizen' segment. In this part, we re-considered each code's description to assess where on the measurement dimensions these transactions were most likely to lie. Each transaction was coded according to its value on the measurement dimensions (refer to Figure 2), from which the following segment statistics were then drawn. This codification was arbitrary, but conducted independently by each researcher and negotiated to arrive at a consensus classification for each code. Again, we believe that this has created 'noiseless' data for analysis. Figure 4 shows the results of this further refinement of the broad 'Citizen' segment (n=118). (These charts reflect the same analysis as described for Figure 3.)



(a) (b) (c)

Figure 4: Distribution of Financial Transactions over Citizen Segments (from project data)

Figure 4 reveals an interesting characteristic: the distribution of 'services' indicates that a high proportion of transactions are aimed at the *Customer* segment. Reviewing the transaction code descriptions reveals that the high number of codes associated with *Customers* results from a high-level of refinement of various 'commercial-like' transactions (e.g. sales of different sizes of aerial photograph, individual codes for each national park entry, retail activity and other items), whereas codes assigned to other segments tend to be more general. However, the distributions of value and activity indicate that *Subject* transactions are dominant. This is probably not surprising as *Subject* transactions are obligatory and include payment of fees, fines and other government imposts. Importantly, the very similar distribution of value and activity implies that the average transaction value is relatively consistent across segments. It is difficult to determine the significance of this finding. It does, however, allow us to only consider the activity data when analysing the results of applying the segmentation to transaction data available to us from the ACT Government.

We tested whether our 'measurements' against each dimension were overly correlated, most likely through a perceptual bias of the researchers. If they were, then one or more dimensions may not be necessary to determine to which narrower 'Citizen' segment a particular transaction belonged. *Table 1* shows the correlations of 'measurements' across each dimension where the occurrence of each measurement is set to one and a lack of the measurement is set to zero.

Table 1: Correlations between Dimensions in 'Citizen' Segment (from project data)

	Interactions			**Differentiation**			**Reliance on Government**	
	Single (S)	Repetitive (R)	Multiple (M)	Commodity (C)	'Menu' (U)	Tailored (T)	None (N)	Government (G)
Interactions								
Single (S)	1.000							
Repetitive (R)	-0.605*	1.000						
Multiple (M)	-0.706*	-0.136	1.000					
Differentiation								
Commodity (C)	0.454[a]	-0.274[a]	-0.320[a]	1.000				
'Menu' (U)	0.031	0.240[b]	-0.252[b]	-0.663*	1.000			
Tailored (T)	-0.589[c]	0.040	0.697[c]	-0.405*	-0.416*	1.000		
Reliance on Government								
None (N)	0.078	-0.013	-0.085	0.464[d]	-0.299[e]	-0.199[f]	1.000	
Government (G)	-0.078	0.013	0.085	-0.464[d]	0.299[e]	0.199[f]	-1.000	1.000

*,a,b,c,d,e Significant at the 0.01 level (2-tailed test); † Significant at the 0.05 level (2-tailed test)

Table 1 needs some explanation. (NB: Levels of correlation (i.e. high, moderate, and low) are described in (Sarantakos, 1998, p395)) Firstly, the high negative correlations between measurements in the same dimensions (marked in *Table 1* as [*]) are appropriate given the classification method and

the approach to creating the correlation (i.e. the assumption of mutual exclusivity of measurements within one dimension). Secondly, the moderately positive correlation between a 'Commodity' Differentiation and a 'Single' Interaction and the corresponding negative correlations with 'Repetitive' and 'Multiple' Interactions ([a]) probably reflects a researcher bias along the lines that commodities should be easy to acquire and hence require only a single interaction to complete the process. Similarly, the low positive correlation between 'Menu' Differentiation (a selection of commodities) and 'Repetitive' Interactions, and the equivalent negative correlation with 'Multiple' Interactions ([b]), demonstrates a similar pre-conception.

Thirdly, the high negative correlation between a 'Single' Interaction and a 'Tailored' Differentiation and the high positive correlation between 'Multiple' Interactions and 'Tailored' Differentiation ([c]) also reflects this bias; tailoring a transaction is likely to require several steps.

Finally, the moderate positive correlation between 'Commodity' Differentiation and a transaction with 'No' Reliance on Government (and its flipside negative correlation, [d]) suggests that we may have tended to assume that commodity transactions are more 'commercial' in nature. This bias is not reflected in the correlation coefficients for 'Single' Interactions that have a 'Reliance on Government'. The tendency is reflected also in the flipside correlations for 'Menu' and 'Tailored' Differentiations with 'Reliance on Government' ([e] and [f]), although these are low correlations at a lower significance level.

Overall, the correlations suggest a measurement bias by the researchers that make almost equivalent the measurements 'Commodity' Differentiation and 'Single' Interaction, and 'Tailored' Differentiation and 'Multiple' Interactions. This raises a question about the need for two dimensions to measure what might be one, compound, idea. However, the correlations between the Differentiation and Interaction dimensions and the Reliance on Government dimension suggest that they are different. Noted above is a correlation between one 'end' of the Differentiation dimension and a measure on Reliance on Government, but there is no correlation between Interactions and Reliance on Government. Consequently, although there is some evidence that the researchers may display a bias in the measuring of services across two dimensions, once all three dimensions are considered, there is no strong pre-disposition towards one service distribution over another.

As Figure 2 indicates, we have chosen to ignore classifications on the Interactions and Differentiation dimensions depending upon the 'measurement' on the Reliance on Government dimension. Reviewing *Table 1* in this light reveals that there is no bias when determining whether a transaction lies in the *Subject* or *Citizen* segment and a small but not significant bias towards the *Customer* segment over the *Client* segment when the Government is not required to be involved.

In light of this analysis, we are content that the three dimensions defined, and our application of them post-hoc to the data from the ACT Government, provide a meaningfully independent manner of classifying transactions for further analysis. All three dimensions are necessary and, for our purposes, are sufficient.

3. Segment-Level Findings

Turning our attention to the differences between the proposed segments, there is some clear evidence that the segments are worth investigating. If the segments represent different statistical populations, then incidental correlations of activity by different segments would not automatically negate claims of differential responsiveness; some larger 'force' might bring correlation among disparate (statistical) populations. The emphasis on *statistical* populations is important; there is no question that all activities recorded came from the same human population. As we are using a benefits segmentation based on 'intent at time of transacting', separate statistical populations are expected to exist within a single actual populace.

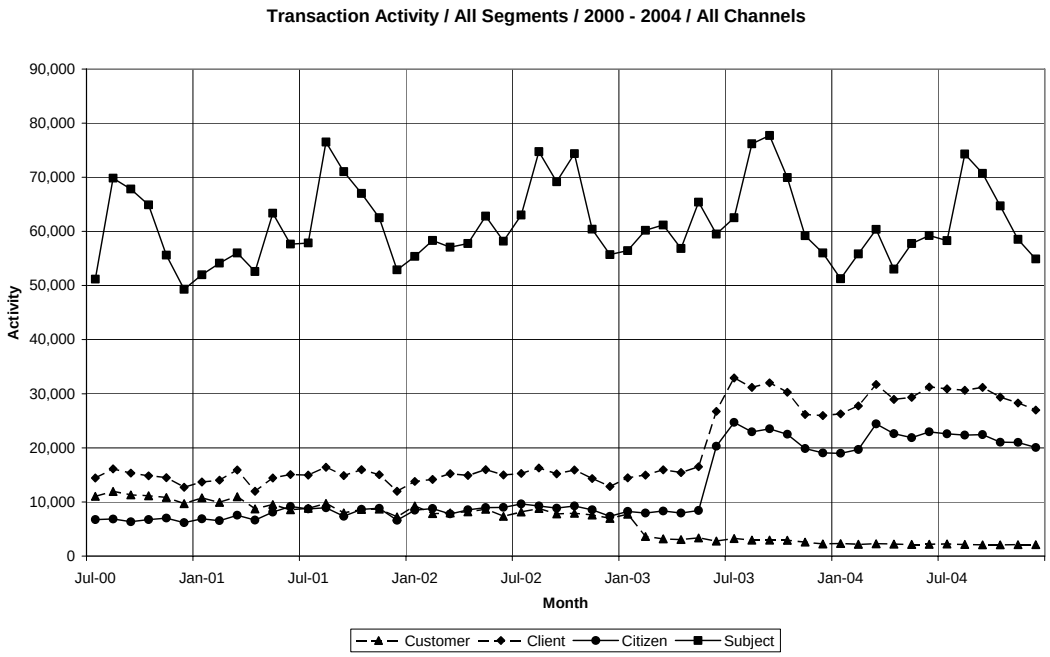


Figure 5: Total Transaction Activity of each 'Citizen' Segment, by Month, Jul 2000 - Dec 2004 (from project data)

The recording of transactions on a monthly basis over several years leads inevitably to a time-series collection of data. Figure 5 uses transaction activity to illustrate the time-series nature of the data available to us. The dominance of activity in *Subject* transactions was described above. The regular (seasonal) shape of the *Subject* graph, particularly the peak immediately following the end of each financial year, is indicative of the types of transactions *Subjects* undertake. Interestingly, the *Client* and *Citizen* segment activity levels, which are otherwise relatively stable over time, increase sharply in June and July 2003. A similar graph of total transaction value does not display this same 'drift'. This implies that in June 2003 the nature of transactions in these segments changed resulting in a lower average transaction value. The *Customer* graph also shows a small 'drift' in January 2003.

Inspecting the data at a transaction code level across the time periods when these 'drifts' occurred revealed two different forces at work. In the *Client* and *Citizen* segments, new transactions were introduced with substantial activity. The new transactions were both related to roads and so were probably new payments required from a piece of legislation that took effect in June 2003. Given the much lesser increase in transaction value at the corresponding time, these new imposts were clearly of small value. In the *Customer* segment, the drop in activity is directly related to the Canberra bushfires of January 2003. Despite a sharp rise in activity brought on by donations made by *Customers*, there was a substantial drop-off in government housing rental transactions (probably because of the loss of those rental properties in the fires).

We could not find any relevant literature to suggest a time series model that could generally fit such time-series data. Therefore, we adopted the basic and conventionally-used method to de-trend and de-mean the data under the principle of time-series analysis: try to use a model that fits the data best. To analyse the time-series data, we first sought to remove the possible time trend and seasonal effect on the segments' activities. Making the data 'stationary' over time allows us to compare the four segments best. Consequently, we adjusted the data for seasonal effect and used dummy variables to remove the unexpected impact of the 'drifts' on the activity level of *Client*, *Citizen* and *Customer*.

For the *Subject* segment, we used common seasonal adjustment methods to remove the seasonal effect. For the *Client* and *Citizen* segments, dummy variables denoting June and July 2003 were used to remove the 'drift', and the linear trend towards time was also removed from the raw data. Some seasonal adjustments were also conducted once the time effect was removed. For the *Customer* segment, dummy variables denoting February 2003 were used to get rid of the 'drift', and the linear trend towards time was removed from the raw data. After these adjustments, the four time series were

shown to be stationary through the Augmented Dickey-Fuller (ADF) test (Table 2): that is, the time trend had been removed from the raw data.

Table 2: Augmented Dickey-Fuller Unit Root test (from project data)

Segment	t-Statistic	Significance level
Subject	-3.25	0.023
Client	-6.06	0.000
Citizen	-4.82	0.000
Customer	-8.43	0.000

Figure 6 shows the distribution of the time-series adjusted data.

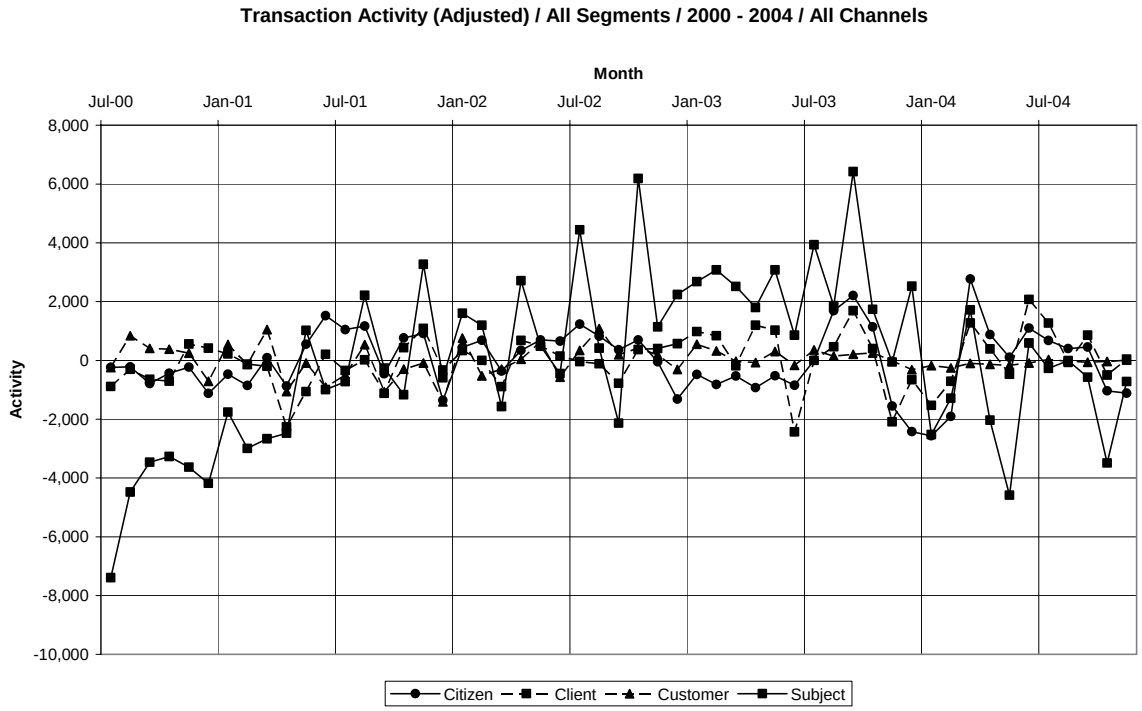


Figure 6: Total Transaction Activity (Adjusted) of each 'Citizen Segment, by Month, Jul 2000 - Dec 2004 (from project data)

Using this data, we can test for independence between the segments; that is, we can test if the data is recorded for (statistically) separate populations. Our contention is that when a person interacts with government online, they display behaviours related to their intention at the time of interacting, and that the intention is sufficient to categorise them as being part of a unique, independent population at the time that they are interacting.

The relevant statistical test for independence between populations is the Kruskal-Wallis H test. Table 3 presents the results of the Kruskal-Wallis H test on the time-series adjusted data.

Table 3: Kruskal Wallis H Test on Time Series Adjusted Data (from project data)

Segment	N	Mean Rank
Citizen	53	27.00
Client	53	132.96
Customer	53	80.04
Subject	53	186.00
	212	

Segment	χ^2 =	197.761
df = 3	α =	0.000

The Kruskal Wallis H test indicates that the (statistical) populations represented by each segment are independent. This is an important observation as Tables 7 and 8 show that before and after time series adjustment, most segments are correlated with each other.

Table 4: Correlation in Segment Activity (before time series adjustment) (from project data)

	Subject	Customer	Client	Citizen
Subject	1.00			
Customer	-0.08	1.00		
Client	0.24	-0.83*	1.00	
Citizen	0.19	-0.84*	0.99*	1.00

* Significant at the 0.01 level (2-tailed test)

Table 5: Correlation in Segment Activity (after time series adjustment) (from project data)

	Subject	Customer	Client	Citizen
Subject	1.00			
Customer	0.18	1.00		
Client	0.42**	0.25	1.00	
Citizen	0.32*	0.20	0.51**	1.00

** Significant at the 0.01 level (2-tailed test); * Significant at the 0.05 level (2-tailed test)

After removing time influence, it is clear that there is no correlation between *Customer* and any other segment. However, the activity level for the other three segments in any given month is correlated.

4. Conclusion

We have shown that the segmentation that we have been using is statistically valid as well as useful, given the measurement dimensions that we have developed. The dimensions are both necessary and sufficient to determine what transactions lie in which segment. Furthermore, the data that results from such segmentation is seen to represent the activities of statistically independent populations.

Again, the transactions are all conducted by a single human population, that of the Australian Capital Territory. However, by segmenting the transaction data along these lines we can see that they behave as if from independent populations. The importance of this is that each independent population will have characteristics that will influence the adoption of e-Government services. By identifying the different populations, the characteristics of these populations can be explored to find what their different adoption triggers and inhibitors might be.

Our future research includes further refinement of the data analysis looking at which transactions are most commonly used by each segment and whether there are distinct trends towards (or away from) Internet adoption for them. We also hope to use the transaction level analysis to underpin recommendations for service design and improvement.

5. Acknowledgements

The authors of this paper are grateful to the Department of Urban Services, ACT Government for access to the data used for this analysis. All observations and conclusions are those of the authors and do not reflect the opinions or policies of the ACT government.

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