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Deriving Spatial Metropolitan Wide Patterns of Quality of Life Dimensions From Survey Data: the Case of the Brisbane-South East Queensland Region in Australia

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Deriving Spatial Metropolitan Wide Patterns of Quality of Life Dimensions from Survey Data: The Case of the Brisbane-South East Queensland Region

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ABSTRACT

Quality of life (QOL) studies typically focus either on aggregate measures of QOL variables using secondary data sources for aggregated spatial units or on primary data collected through sample surveys whereby individuals provide subjective assessments of QOL dimensions. This paper uses sample survey data collected in a 2003 survey of QOL using a spatially stratified sample design across the Brisbane-South East Queensland (SEQ) region, Australia's fastest growing metropolitan region in the 'sun belt'. A 'subjective-well being approach' has been adopted to explore a range of techniques for mapping inter-regional variability. Various aggregation operators – 'Max', 'Min', 'average', exponential and maximum entropy, are employed to develop five QOL indices based on an 'ordered weighted average', a non-linear aggregation technique. It is shown that the quality of life across the Brisbane-SEQ region varies with substantial differences exhibited across different weighting regimes.

KEY WORDS: Quality of life, life-satisfaction domains, aggregation, ordered weighted average and GIS

1. INTRODUCTION

The characteristics of geographic space may play a significant role in creating regional variation in people's perceived quality of life (QOL). Because differences are embedded in geographic spaces in terms of their environmental, economic and social characteristics, variations in QOL might be expected as a characteristic of the living in urban areas. Previous studies in QOL research have focused on two levels of analysis. At an individual or micro level, where satisfaction with life is subjectively assessed by individuals, or at an aggregated or macro level, where objective indicators (such as crime rates, poverty, health, accessibility, pollution) are used to develop a composite ranking indicating regional variations in the QOL. There have been attempts to integrate data obtained at these two levels (Cutter, 1985; Rogerson, et al. 1989; Chhetri, et al. *in press*). But the aggregation of individual level QOL data collected through surveys into sub-regions of a city to identify spatial variability has not been given much attention, despite the availability of aggregation techniques to do so. The mapping of spatial variability in subjective QOL might have useful applications in urban and regional planning for urban development.

In this paper, we argue that the scored subjective assessments derived from survey data when aggregated can be treated as indicative of the collective well-being of people. For example, disaggregated data collected through surveys can be aggregated to measure specific QOL for particular groups such as women, minorities, older people and so on. In a similar way, aggregation can also be undertaken on a spatial basis for areas or regions. Mercer (1994: 5) has measured QOL on "a range of factors that make us feel good about being and staying – in a place". In other words, QOL assessments, when aggregated for areas, can indirectly reflect the spatial variation in perceived QOL. However, Marans (2003) asserts that QOL in a place

or a specific geographic setting is a subjective phenomenon and, therefore, may vary according to an individual's gender, perception, cultural and ethnic background, socioeconomic status, educational level, family situation, health, disability, age and or past experiences. The approach adopted in this paper is to analyse individual ratings of QOL items, to aggregate those ratings, and then to derive average or collective scores for subregions within a large metropolitan region to represent spatial variations in levels of wellbeing.

With sub-regions as the criterion for spatial aggregation, the paper uses a number of techniques to measure and map aggregated subjective assessments of QOL across various life satisfaction domains. The paper begins with a brief discussion on the concept of quality of life, and methods and approaches to its measurement. It then outlines the procedures used for data collection, and discusses the aggregation techniques used. Outputs produced by the statistical and spatial analyses are then discussed.

2. QUALITY OF LIFE: AN OVERVIEW

2.1 Defining QOL

QOL relates to the total well-being of people, including physical, mental, social and spiritual components (Eckersley, 1998). The object of evaluation in QOL is the 'life' (Veenhoven, 2000), where the focus is on assessing the life of an individual. 'Well-being', 'happiness' and 'life satisfaction' have all used as proxy indicators of QOL. Happiness tends to be more concerned with the psychological aspects of life and perhaps is state-centred (that is, moods, feelings and emotions). A 'satisfaction based measurement' has been adopted in the research

presented here, because, as argued by Campbell et al. (1976) and Marans (2003), it comprises more definable properties and it implies judgemental or cognitive experiences, whereas 'happiness' reflect a relatively short-term mood of elation or gaiety. QOL is thus a multilayered and multi-dimensional concept (Marans and Rodgers, 1975; Marans, 2003; McCrea et al., 2005). It is multi-layered in the sense of its representation at the level of individual, family and community, and it is multi-dimensional in its reflection of various aspects of life.

2.2 QOL measurement

The literature is replete with attempts to measure QOL, although there is no widely accepted model or measure. There are many debates around how best to measure QOL or of its reflection in various aspects of daily life. Traditional measures are typically 'objective' and 'subjective'. 'Objective' QOL "reflects objective circumstances in a given cultural or geographic unit... (and) are based on objective, quantitative statistics" (Diener and Suh, 1997: 192). For example, it incorporates health indicators, crime rates, education levels, work force participation, proportion of welfare recipients in a given area are indicators of objective QOL. 'Subjective' QOL is "based on reports from individuals on the 'meaning' of aspects of their reality, and as such represent psychological variables" (Carley, 1981: 31). These are assumed to be defined "by people's conscious experiences – in terms of hedonistic feelings or cognitive satisfactions" (Diener and Suh, 1997:191). Veenhoven (2000) has identified four interdependent categories of QOL by distinguishing 'opportunities (chances) for a good quality of life' and 'the good life itself as an outcome'. These include the liveability of the environment, the life-ability of the individual, the external utility of life and the inner appreciation of life.

In surveys, QOL is often measured by asking subjects to evaluate their level of satisfaction with various aspects of life. Responses are captured using a standard response format – such as a Likert scale, which yields a numerical rating (Trauer and Mackinnon, 2001). However, aspects of quality of life might not hold the same importance for everybody, and, as a result, the evaluation of the importance of each aspect has sometimes been built into the questionnaire instrument used to collect data in a survey (Gill and Feinstein, 1994). When the satisfaction ratings for various life satisfaction domains are multiplied by their importance ratings and then summed, a composite score indicating the overall QOL may be generated. Such a score, with its unique weightings assigned to various life satisfaction domains, represents global subjective QOL (Oliver et al. 1995), with lower weights being allocated to those domains that contribute little to the person's life satisfaction (Cummins, 1995). Trauer and Mackinnon (2001: 584) while exploring the conceptual, psychometric and empirical issues pertaining to this approach, suggest that "satisfaction ratings already reflect a personal appraisal of the importance of the domain...and that the multiplicative composite of satisfaction and importance has extremely undesirable measurement properties and may be difficult to interpret". In this paper we adopt a methodology that assigns weights on the basis of different scenarios to resolve some of these problems.

2.3 Domains-of-Life approach

In adopting a 'subjective well-being approach' to the study of QOL as reported by respondents to a survey, satisfaction with life in a number of domains was assessed following the strategies developed by other researchers (Cummins, 1996; Headey and Wearing, 1992; Salvatore and Muňuz Sastre, 2001). The domain of life approach appraises life as a whole on the basis of a multi-dimensional vector of specific appraisals in more concrete spheres of well

being (Rojas 2004). Debates surround the number of independent domains; nevertheless, partitions based on parsimony, meaningfulness and usefulness underpin their success (Rojas, 2004). Cummins et al. (1996) has identified seven domains: material well-being; health; productivity; intimacy; safety; community; and emotional well-being. Van Praag et al. (2003: 3) added satisfaction with life as a whole as an aggregate concept which, if unfolded, represents the sum of its domain components (health, financial situation, job, housing, leisure and environment). In the study discussed in this paper, satisfaction with life as a whole and with its various domains are subjectively assessed in terms of perceived well-being.

3. METHODOLOGY

3.1 The study area

The Brisbane - South East Queensland (SEQ) region in Australia has been experiencing rapid growth and socio-economic transformation for several decades. The region is characterised by a poli-centric urban structure, connecting the Queensland State capital, Brisbane, with two coastal growth corridors – south to the Gold Coast and north to the Sunshine Coast (which are tourism regions) - and with a less rapidly growing inland western corridor through Ipswich, a long-established industrial and mining city. The region's population increased from 1.8 to about 2.4 million over the decade (1991 to 2001), and it is forecasted to reach about 3.2 million by 2011. In order to strategically plan infrastructure and sustain the current rate of growth, it is important for planners to evaluate QOL of people occupying different residential mosaics across the urban social spaces of the region. Mapping of those variations may enable identification of areas deficient or rich in a particular domain of QOL or a combination those domains. Studies such as this can add to the evidence base relating to the identification of factors affecting people's QOL and their adopted lifestyle and life choices in different places.

3.2 Data collection

In 2003 a Quality of Life (QOL) Survey in Brisbane–SEQ was conducted by researchers at the University of Queensland. It was a spatially stratified probability sample survey using the Computer Assisted Telephoning Interviewing facility at the University to collect data through a telephone survey mode. A total of 1,612 survey participants aged 18 years and older were interviewed. Data was collected on the standard socio-economic and demographic characteristics of respondents, along with locational information of their place of residence and work, plus a wide range of information relating to perceived QOL across life satisfaction domains and the behaviour of people with respect to work, recreation and consumption.

3.3 Measurements

Life satisfaction was measured by asking survey respondents this question: '*How satisfied are you with your overall quality of life*'. It was measured on a five-point Likert scale, where 1 represents 'very dissatisfied' and 5 'very satisfied'. Twelve questions were asked to assess satisfaction with the following aspects of life; as '*your employment situation*'; '*the amount of money you have available to you personally*'; '*your housing*; '*the amount of time you have to do things you want to do*'; '*your relationship with your partner*'; '*your relationship with your children*'; '*your independence or freedom*'.

3.4 Aggregation techniques

The 'weighted average operator' is one of the most commonly accepted composite indices that may be derived from a set of scaled responses to survey questions. The term 'composite index' can be defined as an aggregation of the indicator values which collectively convey information about the quality of some complex aspects or components of a condition (Nijkamp et al., 1990). In the 'Weighted Average operation', indicators are multiply with their associated weights and then added together to construct the overall index. In the quality of life research weights are often assessed by asking people to assign importance scores to each item assessed in the survey. The index can be expressed as

$$U = y_1 x_1 + y_2 x_2 + - - - + y_n x_n$$

where X_n is the nth indicator, and Y_n its corresponding weight.

The 'Ordered Weighted Average' (OWA) is often used for aggregating multiple indicators to form an overall score. This is a relatively new but flexible method of aggregation. It allows the users to decide upon the types of aggregation depending on the purpose of their decision-making (Filev and Yager 1998; Mendes and Motizuki 2001; Smith 2001; Yager 1988; Yager 2004). The basic formula of OWA is given as:

$$F = w_1 b_1 + w_2 b_2 + \dots + w_i b_i$$

where b_1 , b_2 , ----, b_n are the positional values of the indicators, and w_1 , w_2 , ----, w_n are the weights of those positional values. OWA aggregation is a non-linear aggregation because it uses an ordering process to aggregate the indicators' values. The value of the weights ranges between 0 and 1.

Yager (1988) proposed 'OWA Operator'. The operator can be used to evaluate the performance of urban areas on quality of life indicators (Mendes and Motizuki 2001). The overall performance rating depends upon the criteria used to assign weights to the indicators based on their importance in the subjective assessments of subjects. There can be a situation where all indicators hold the same importance, while in other situations satisfaction with one of the indicators is all that is desired. For example, for older people health status may be a far

more important domain than employment status. Therefore, their quality of life is heavily dependent on health related indicators. On the other hand, weightings might not be the same for a young unemployed person. These combinations of situations can be adjusted through the use of 'And' and 'Or' operators, which combine the function that an indicator performs in the overall ranking (Yager 1988, 183).

According to Yager (1988), an 'OWA operator' of dimension n is a mapping function

$$f: \mathbb{R}^n \to \mathbb{R},$$

that has an associated weight vector W,

$$W = [w_{1}, w_{2}, w_{3}, \dots, w_{n}]^{T},$$

Such that

$$\sum_{i=1} w_i = l,$$

The functional value $f(a_1 - a_n)$ determines the aggregated value of arguments $a_1, a_2 - a_n$ in such a manner that

$$f(a_1 - \cdots - a_n) = \sum_{j=1}^n w_j b_j$$
 (Aggregation equation),

where b_j is the *j*th largest element of the collection of the *n* aggregated objects (here, indicators) $a_{1,} a_{2}$ ---- a_n (Filev and Yager 1998).

A fundamental aspect of the 'OWA operator' involves ordering the indicator values. If we consider ranking the indicator scores from highest to lowest, the indicator with the highest score is given the first order weight; the indicator with the next highest score is given the second order weight; and so on. This has the effect of weighting an indicator based on their rank in a descending order from maximum to minimum. Thus argument a_i (a particular

indicator value) is not associated with a particular weight w_i but rather a weight w_i is associated with a particular ordered position *i* of the argument (Filev and Yager, 1998: 158). A known property of the 'OWA operators' is that they include the *Max.*, *Min.* and arithmetic mean operators for the appropriate selection of the vector *W*:

- For W = [1, 0, 0, -0], $f(a_1 --- a_n) = Max_i a_i$ [Optimistic OWA (OP-OWA)]
- For W = [0, 0, 0, ---1], $f(a_1 --- a_n) = Min_i a_i$ [Pessimistic OWA (PE-OWA)] and

• For
$$W = [1/n, 1/n, \dots 1/n]$$
, $f(a_1 \dots a_n) = \frac{1}{n} \sum_{i=1}^n a_i$ [Average OWA (AV-OWA)].

All 'OWA operators' are bounded by the *Max* and *Min* operators [*Min_i* $a_i \leq f(a_1 - ... - a_n) \leq Max_i a_i$] (Filev and Yager, 1995; Filev and Yager, 1998). Recently other types of OWA operators (that is, 'maximum entropy OWA', and 'exponential OWA') have been developed (Smith, 2001; Filev and Yager, 1998).

A somewhat simpler approach, which does not require the solution of a non-linear programming problem, is the 'Exponential OWA Operator' (EX-OWA) (Filev and Yager, 1998). This method is an alternative solution to the constrained optimization problem. OWA weights can easily be generated according to either of the following equations:

$$W_1 = \theta_1, W_2 = \theta_1(1-\theta); W_3 = \theta_1(1-\theta)^2; \dots, W_{n-1} = \theta_1(1-\theta)^{n-2}; W_n = (1-\theta)^{n-1}$$
 [EX-OWA]

Here, θ is a parameter of the indicators that belongs to the unit interval, $0 \le \theta \le 1$.

Yager (1988) used the dispersion or entropy (evenness) associated with a weighting vector. He used this measure to develop a procedure to generate the OWA weights that have a predefined degree of Orness α . That is, the weights will be as even as possible (maximizing entropy) subject to yielding a given level of Orness. These are called as 'Maximum Entropy OWA' (ME-OWA) weights. This approach is based on the solution of the following constrained non-linear optimization problem (Smith, 2001):

Maximize
$$E(W) = -\sum_{i=1}^{n} w_i ln w_i$$
 [Maximum Entropy OWA]
Subject to $\alpha = \frac{1}{n-1} \sum_{i=1}^{n} (n-i) w_i$ ($\alpha = orness$)
 $w_i \in [0,1], i = 1, ----, n$

The quality of life in this research has been assessed on a range of life satisfaction domains. The aggregation techniques discussed above are used to weight QOL indicators described on various life satisfaction domains. In the following section we will report on the results derived from those aggregation operators and analyse the inter-regional variability in QOL.

4. **RESULTS AND ANALYSIS**

The overall aim set out earlier for this paper is to compare spatial patterns in the perceived QOL of people at a collective level as reflected in different weighting regimes. This section reports the results of the statistical and aggregation techniques, maps the output results and interprets the spatial patterns in association with the socio-demographic and economic characteristics of sub-regions in the study area.

4.1 Descriptive Statistics

Table 1 gives the means and standard deviations of the scores of perceived life satisfaction domains. For satisfaction with social relationships, housing, independence/freedom, family life, friends, the means are greater than 4 on the 5-point Likert scale. With the overall standard

of living in the Brisbane-SEQ Region and life as a whole, respondents have given high satisfaction scores. On the other side of the spectrum, for six life satisfaction domains, satisfactions with the amount of money, the amount of free time available, romantic relationships, employment situation, leisure time and health, the overall score reported by the respondents are slightly lower being between 3.1 and 3.9. It also needs to be noted that items with relatively lower scores have high standard deviations; while for items with high satisfaction scores lower standard deviations are found.

Satisfaction with	Mean	S.D.
- the amount of money you have available to you personally	3.12	1.20
- the amount of time you have to do the things you want to	3.29	1.22
- your romantic relationships	3.77	1.27
- your employment situation	3.78	1.15
- the way you spend your leisure time	3.88	0.95
- your health	3.89	0.99
- with your social relationships	4.01	0.88
- your housing	4.19	0.85
- your independence or freedom	4.20	0.91
- your family life	4.24	0.91
- your friends	4.26	0.75
- living in the Brisbane - South East Queensland Region	4.36	0.71
- your overall standard of living	4.07	0.80
- your life as a whole	4.24	0.73

Table 1: Descriptive statistics for quality of life items

4.2 Aggregation - Ordered Weighted Average Operators

The subjective evaluations of quality of life derived from survey data have no explicit geographic properties. In order to aggregate data geographically, twenty one sub-regional areas were generated. These sub-regions are identified on the basis of two criteria: first administrative uniformity and compatibility with census geographies; second, similarity in the socio-economic and demographic characteristics. SEQ sub-regions delineated by Stimson et al. (1997) are used for areas within the Brisbane metropolitan area, whilst Local Government Areas (Local Councils) are adopted for the remainder of the SEQ region. Using the 'point-in-

polygon function', QOL survey data geocoded for every participant at a street level were aggregated into a GIS database generated for sub-regions.

Subjective scores obtained on a number of items could be aggregated by using either a 'weighted average' (WA) or 'ordered weighted average' (OWA). The former is a linear aggregation operator while the latter is a non-linear aggregation operator. In this paper we have used OWA because it provides a method of allocating different weights to indicators over different scenarios.

In order to aggregate data across 21 sub-regional areas, subjective scores on various items need to be aggregated. As an example, to illustrate the process involved, Table 3 shows that there are 54 participants in one of the 23 sub-regions – Sub-region 1 (R1); the scores of survey respondents living in this sub-region on satisfaction with employment are aggregated and then converted into percentages. These values for different sub-regions are then transformed from 1 to 0 on the basis of their positional rankings. The procedure is replicated for all items in the survey. This gives us a table with all the indicators sorted on the basis of their positional values.

Region	Level of satisfaction	Employment (Count)	Employment (Percentage)
R1	Very dissatisfied	9	16.67%
n= 54	Dissatisfied	8	14.81%
	Neither satisfied nor dissatisfied	14	25.93%
	Satisfied	17	31.48%
	Very Satisfied	5	9.26%
		54	100.00%

Table 3: Transfer of location-specific QOL survey data into sub-regions.

In order to measure and compare the performance of 21 sub-regions across the SEQ region study area on the QOL domains, OWA operators were used to aggregate items derived from the survey data. Items aggregations by OWA operators were implemented using Visual Basic for Application (VBA) in MS Excel and MathCAD. The values of OWA operators vary on a scale between 1 (one) and 0 (zero). Here 1(one) means 100% satisfaction or the ideal condition of the indicators existed, and 0 (zero) means that the indicators revealed 100% dissatisfaction.

Under the 'ordered weighted average' (OWA) operators, while considering the positional values of the QOL items and nonlinear arithmetic and/or exponential aggregation, performance of sub-regions on the QOL measures varies between 30% and 97% of the ideal condition, depending on the model that is considered. For instance, under the MAX-OWA operator, the average score on the QOL item is about 90% of the ideal condition. In contrast, under the MIN-OWA operator, the average score on the average score on the QOL item is 39% of the ideal condition. AVERAGE-OWA reveals the trade-off among the QOL items, and the average score is about 70% of the ideal condition.

Under the 'Exponential-OWA operator', the average life satisfaction score calculated for this operator is 42% of the ideal condition (while considering the low level of 'orness') and this is 82% of the ideal condition (while considering the high level of 'orness'). The 'Maximum Entropy-OWA operator' considers some constraints of the indicators, which means considering the desired degree of 'orness' to maximize the evenness among the QOL indicators. Under this operator, the QOL score is about 60% of the ideal condition (while 'orness' is low), and that situation is about 80% (while 'orness' is high).

4.3 Inter-Regional variability

In terms of inter-regional variability, the sub-regional pattern shown in the first map (Figure 1) dealing with the 'MAX-OWA' operator indicates that areas with highest scores are Caloundra, Noosa, Caboolture, Pine River in the Sunshine Coast and SEQ-Outer and Ipswich-Outer in the interior of the SEQ region. It has been found that Sub-regions within Brisbane metropolitan area and Gold Coast have emerged to offer low QOL. On the 'Min OWA' scores for the item that scored lowest among all other items, a similar pattern to that of 'Max OWA' operator has emerged. Caloundra, Ipswich (C), Northern Outer, Eastern and Southern Inners, are found to be excellent QOL scores on the item that has minimum value, followed by SEQ region, Gold Coast Inner and Outer, and Pine River (Figure 2). Most sub-regions in the outer Brisbane, except Northern Outer are among those with low quality of life scores. When all QOL items are given the same weight, a clearer pattern starts to emerge in the Average OWA regime. Most sub-regions along the coast and in the interior parts of SEQ region have high QOL scores. It is perhaps an indicative of the effects of proximity to natural areas such as creeks, beaches and parks on the lifestyle that people choose to pursue, particularly for baby boomer generation. Logan has low scores on Max, Min and Average weighting regimes, whilst Gold Coast Inner has scored low on the item that has maximum satisfaction score but has performed reasonably good on the Min and Average OWA weighting regimes.

However, much greater spatial differentiation starts to emerge for the next two weighting regimes – 'exponential operator' (Figure 4) and 'maximum entropy operator' (Figure 5) operators. Some of the sub-regions – for example Northern Outer, Eastern and Southern Inner in the Brisbane metropolitan area – perform better on these two regimes. But to our surprise, the tourism area of Noosa drops its position, while Gold Coast Inner emerges to be a winner on both of these indices. The spatial patterns in the exponential and maximum entropy are

somewhat similar (correlation coefficient $r^2 = 0.72$), although they still share some similarity with Max, Min and Average operators in terms of high scores for the coastal and interior sub-regions within the SEQ region.

To recapitulate, most sub-regions in Brisbane city have relatively performed less well on the QOL rating, except the Outer Western suburbs. Regional and coastal sub-regions surprisingly have high QOL scores. These results support the findings of earlier studies (Andrews and Withney 1976; Lane, 1993) that economic well-being may not necessarily result greater satisfaction with various aspects of life. Even greater access to economic opportunities, public transport and facilities has minimum effect on the perception of QOL. Sub-regions or parts thereof are also identified areas that have indicated low scores on the social anomie scale.



Figure 1: Inter-regional variability in the QOL using 'Max OWA operator'



Figure 2: Inter-regional variability in the QOL using 'Min OWA operator'



Figure 3: Inter-regional variability in the QOL using 'Average OWA operator'



Figure 4: Inter-regional variability in the QOL using Exponential OWA operator



Figure 5: Inter-regional variability in the QOL using Maximum Entropy OWA operator

5. LIMITATIONS

Interesting regional patterns have emerged in different indices used in this paper. Some patterns were similar; others contrasting although they emerged measuring the same construct, that is quality of life. We argued that satisfaction that people reported with their lives or with its various aspects when explored in different weighting regimes is perhaps better understood than using a composite index. However, the data collected at an individual level when aggregated to a collective level and converted into a single index or multiple indices has a number of limitations that need to be highlighted. These are discussed as following:

- Firstly, the size of sample is vital for the aggregation of data. For example, a dataset with a small to medium size sample or the use of geography (e.g. suburbs) with too many areal units can result in low frequency or counts when aggregated. The data collected for this study was a spatially stratified sample which was designed to capture at least 100 respondents in each of the ten regions within SEQ region. However, in this study we have used 21 sub-regions for aggregation that has reduced the number of sample as low as 45 in one of the sub-regions.
- Secondly, since indices are aggregating results for a number of items or variables, the
 effect of an individual item on the quality of life remains unknown. The items are
 ordered by their positional values from high to low before the index measuring the
 overall quality of life can be constructed.
- Thirdly, intra-regional variability within a sub-region could not be explored in these indices. Diversity measures such as Simpson's index or Herfindahl index are relatively better measures in terms of capturing intra-regional variability in quality of life which the ordered weighted average indices were enabled to measure.

Fourthly, the choice of an appropriate spatial unit, for instance a suburb or local council, is critical for the analysis as the pattern may vary at different levels. This study made use of local council boundary for areas other than Brisbane metropolitan area where sub-regions – amalgamation of suburbs, are used as units for spatial aggregation. This enabled the census geographies to be integrated and incorporated in the analysis.

6. CONCLUSIONS

Overall QOL in the SEQ region as expressed by the survey respondents has been exceptionally high. However, there are life satisfaction domains where satisfaction has been noted to be quite low. The survey respondents usually report relatively low level of satisfaction with the amount of money, available leisure time and employment situation and often struggle to manage their romantic relationships and health. In order to develop a composite index, an approach based on a number of operators was used to analyse aggregated data.

'Ordered weighted average operators' (OWA) were used to aggregate the values of all quality of life dimensions in five different weighting regimes. Five different indices were computed and mapped inter-regional variability in the QOL across 21 sub-regions. All types of aggregation show that the average QOL score varies between 30% and 97% of the ideal condition, depending on which the operator is being considered. Average-OWA, where items are equally weighted, reveals the trade-off among the items and the average score is about 70% of the ideal condition. In the other weighting regimes, clear spatial differences in people's perceived QOL were revealed across the entire SEQ region. The results suggest that

there are sub-regions which have more access to amenities and connectedness to employment opportunities and activity centres in fact have low QOL scores. Contrary to this finding are those sub-regions which are aligned along the coast, which are situated in relatively more interior parts of SEQ region, have performed well in all the different weighting regimes. For the mapping the use of weighting regimes has enabled the identification of sub-regions – for example, Gold Coast Inner – which have low QOL scores on some items but high scores on others. On the other hand, the use of different QOL indices has an apparently negligible effect on the performance of some of the sub-regions (for instance Logan).

Thus, it seems to be important that a variety of 'weighting' routines be used and outcomes compared in order to measure and evaluate the spatial variations (at a sub-regional level of aggregation) in perceived QOL on life satisfaction domains when transferring individual level survey data into aggregated spatial measures of QOL.

We argue that the perceived quality of life when investigated in different weighting regimes has discerned myriad interpretations and meanings depending on what it is based on and its inter-regional variability has been spatially expressed to reflect the levels of collective well being of people.

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