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ABSTRACT

The Griffith Service Access Frame (GSAF) is a model used for quantifying the access disadvantage to educational services of remote and rural areas in Australia. The model was specifically developed to assist policymakers and administrators in allocating resources. The problem with the current funding formula used by the Australian federal government is that densely populated areas secure a higher proportion of funding than those areas that are geographically isolated and have the greatest access disadvantage. The GSAF model is based on several assumptions: that there is a direct relationship between the level of services available and population-center size, that access to services is dependent upon the distance between the location of the client population and point of service, and that access to services is dependent upon the economic capacity of the community to meet the costs of overcoming distance. An access score is calculated based on population-center size, time and cost factors converted into a distance equivalent, and an index of economic resources available to a population center. A survey was conducted to assess whether the GSAF remoteness component matched educators' perceptions of the remoteness or access disadvantage of schools in the Northern Territory. Forty-nine of 60 questionnaires were returned. Results indicate that there is substantial agreement between the perceptions of school staff and the GSAF method for ranking schools for remoteness. The Northern Territory Department of Education has adopted the GSAF model for allocating Country Areas Program funding, and the Commonwealth (federal) Department of Employment, Education and Training is considering using this model for national allocation of program funding. (LP)

A NORTHERN TERRITORY APPROACH TO QUANTIFYING "ACCESS DISADVANTAGE" TO EDUCATIONAL SERVICES IN REMOTE AND RURAL AUSTRALIA

D A Griffith — Australia

This paper describes a new model, the Griffith Service Access Frame (GSAF), for quantifying the access disadvantage of remote and rural populations to educational services

The model can be used at the national, state or regional level in any country that has reliable census data. The model was developed specifically to assist policy-makers and administrators to allocate resources in a way that would overcome or minimise access disadvantage. This is a necessary condition in social justice and equity programs where resources are allocated on the basis of the relative need of specific target groups

A model used to allocate social justice resources should allow policy makers to determine the level of eligibility at which extra resources should be provided A model should also be transparent enough to allow target groups to verify that their allocation is equitable, have face validity and be based on accepted data and research techniques.

THE EXISTING MODEL

The current formula used by the Australian Federal Government (the Commonwealth) to allocate resources to those States and Territories whose population suffer from an access disadvantage to educational services are in urgent need of review as they do not effectively allocate resources on the basis of relative need and lack perceptual validity The Commonwealth's Department of Employment, Education and Training administers a program, the Country Areas Program, that specifically targets students who have limited access to social, cultural and educational services due to geographical isolation This program has been the vehicle for addressing the educational access disadvantage of Australian students in rural and remote areas for the last twelve years.

The access to services approach is based on the assumption that people in rural and remote areas are entitled to the same quality of education as those in urban centres. It is sometimes argued that rural and remote students require a different kind of education more suited to their lifestyles Similar arguments could be made for teaching indigenous peoples A problem with this argument is that it tends to suggest that a special kind of education should be provided that is different from urban, mainstream education delivery However, a certain level and commonality of knowledge is demanded for entry into tertiary education The requirement for a level of education that allows access to urban life opportunities and access to the highest levels of tertiary education supports an argument for educational portability Education provision to rural and remote communities must equate with urban levels and standards to allow portability.

The current Country Areas Program formula allocates funding to States and Territories on the basis of distance and population centre size However, the way these two elements are used within the formula together with the ongoing reliance on outdated 1976 census data, causes significant distortion in the allocation of resources. In the population centre size element of the formula, population in centres of less than 5 000 and greater than or equal to 1 000 are given a weighting of one whilst populations in centres of less than 1 000 are given a weighting of two. The location of the population centre is not taken into account. This results in all population centres of less than 5 000 being made eligible for funding even if they are in close proximity to a large urban centre or city. The result of there being no restriction on the location of 1 000 and 5 000 population centres is that it gives a heavy weighting to densely populated areas that are not necessarily geographically isolated.

In the distance element, population centres of 10 000 are used as the population service centre from which distances of 100 km and 150 km are calculated.The population beyond 100 kms are given a weighting of one whilst those over 150 kms are given a weighting of two There is no further weighting for distances beyond 151 kms This results in a person 151 kms from a 10 000 population centre being treated exactly the same as a person 650 kms distant. The distance element, by setting a maximum threshold of 151 kms, effectively determines that the degree of access disadvantage is the same for all persons living beyond that distance. This limitation significantly understates the access disadvantage of populations living in remote areas.

The major problems with the current formula are that both elements favour the most densely populated areas of Australia rather than those that are geographically isolated and have the greatest access disadvantage. Further the population centre thresholds of 10 000, 5 000 and 1 000 used in the formula are arbitrary and not research based.

The distance thresholds of 100 kms and 150 kms are also arbitrary, as are the weightings for both elements The result of using a population density approach of this kind is that the most densely populated areas secure a higher proportion of funding than one would expect in a program targeting access disadvantage.

The Country Areas Program specifically identifies students with limited access to services as its target group. Therefore, this program needs a model that quantifies relative access to educational services to ensure that funding is allocated on the basis of a student's relative degree of access disadvantage. The Griffith Service Access Frame (GSAF) was developed for this purpose.

THE NEW MODEL

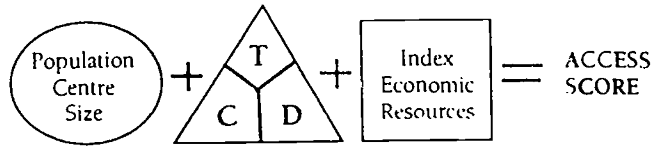
The GSAF model provides a methodology for the measurement of access to a range of services, or a specific service, for all locations in Australia. It does not attempt to define boundaries between urban, rural or remote areas.

Like many other approaches used to construct indices of isolation or remoteness, the model incorporates distance and size of population centre but also an additional element derived from the Australian Bureau of Statistics Index of Economic Resources.

The model is based on three underlying assumptions:

1. There is a direct relationship between the level of service available and population centre size;
2. Access to services is dependent upon the distance between the location of the client population and point of service, and
3. Access to services is dependent upon the economic capacity of the community to meet the costs of overcoming distance

DIAGRAMMATIC REPRESENTATION OF THE GSAF



Elements of the Griffith Service Access Frame

Key

○	Size	Census Population of Centre
△	Time/Cost/Distance	Time or cost capable of being converted into distance equivalent
□	IER	Index of Economic Resources: An Australian Bureau of Statistics composite measure available at Collectors District level

An access score is calculated for each population centre in the following way:

1. A service or basket of services is determined and the location from which they can be accessed (service access centres) is identified. Alternatively a surrogate population centre threshold can be used (this is less accurate) if it is known that the level of service is normally provided.
2. A score is then generated for each of the three elements for each population centre accessing services from the identified service access centres.
3. Principal Component Analysis is undertaken to relate each centre to every other centre in the model to generate the relative weights of the elements in the model. Principal Component Analysis (PCA) was chosen after investigating a number of multivariate statistical analysis methods. PCA was deployed to develop a linear relationship among the three chosen factors, population centre size, time/cost/distance and economic resources based on the variances within each factor and the correlation matrix of variables PCA is a well established method used to synthesise a range of variables and is common in statistical computing packages.
4. Element scores are generated for each population centre seeking services.
5. The weighted sum of element scores is calculated to derive a service access score for each population centre.

It is essential that the user must clearly define, in a quantative sense, the service or group of services to which access is required As with any model of this type, the validity of the result depends upon the data fed into the model. Therefore, selection of the service access centre is a crucial step in the functioning of the model.

HOW THE GSAF WORKS

The GSAF is a three dimensional model which uses data from the Australian Bureau of Statistics' smallest unit of population analysis, the Census Collection District. In urban areas Collection Districts average about 300 dwellings, whilst in rural areas the number of dwellings in Collection Districts is less (as population density decreases). The use of Collection Districts allows detailed analysis of population and geographical areas. In the GSAF model each population centre is given an individual Service Access score generated across the three elements of the model.

THE THREE ELEMENTS OF THE SERVICE ACCESS FRAME

The Service Access Scores are developed using the three elements of the model that, when combined, produced a score that quantifies the relative access of the population centre.

1 **Population Centre Size** is the first leg of the frame. Size is a well established indicator of the range of services available within a population centre. The validity of using population centre size as an indicator of service provision in Australia

has been established by research in Tasmania (Scott 1964), South Australia (Smailes 1969) and Queensland (Dick 1971). Population centres in the GSAF are ranked through 10 size classification from over 500 000 to below 200 based on the actual clustering of population centres by size in Australia. Population centre size is a reliable indicator of the level of service provision, therefore, the larger the centre is, the lower the element score it generates.

2 Time/Cost/Distance Units allow the relative time, cost and distance from the service centre to be calculated for each population centre. Time, cost and distance have significant influence on access (Morrell 1974, and Vickerman 1980). The time/cost/distance unit incorporates three sub-elements The average distance travelled by the average motor vehicle on all types of road surfaces in Australia is 75 kilometres in one hour. These two factors provide the basis for the distance and time sub-elements. The cost of the traveller's time (calculated by using an hourly rate of pay based on the national modal wage) together with the standing and running costs of the motor vehicle for one hour comprise the cost sub-element.

These sub-elements are combined into the time/cost/distance unit. Air travel can also be built into the unit by dividing the air fare by the cost value of the sub-element to get the quotient which is then multiplied by the average speed per hour to convert the fare into a kilometre equivalent.

The time/cost/distance unit gives its three factors an equivalent value enabling the calculation of the relative access. Both time and cost can be translated into a distance equivalent. There are 30 time/cost/distance rankings required to determine the relative access of the remotest population centres in Australia.

3 The Economic Resources available to a population centre is an important factor in calculating access to services. A population centre's economic resources score is derived from, the Australian Bureau of Statistic's Index of Economic Resources (ABS 1993), which in turn is derived from 1991 census data.

The Economic Resources Index identifies the level of economic resources within a population centre. This index provides the means of calculating the economic capacity of population centre to overcome the cost of travel relative to all other localities in Australia. There are 10 rankings in the economic resources element from 1 000, which is the Australian mean score and above which there is no disadvantage, to less than 550. Less than 550 is a very low score only occurring in Aboriginal communities.

COMBINING THE ELEMENTS

The three component elements of the Service Access Frame are combined to provide an access score for each population centre in Australia relative to a level of service provision. The Service Access Score is derived by using Principal Component Analysis (as described above) to combine the three element scores. The access profile provides a simple exposition of the impact that each of the three elements have upon a population centre's access to services The combination of the three elements allows a more precise profile of access to be constructed.

APPLICATION OF THE MODEL

A trial analysis conducted for the Country Areas Program in Queensland in 1992 demonstrated the face validity of the model based on a service access centre population of 10 000 Further analysis of service access centres of 50 000 and 25 000 were conducted. However, due to the lack of a clear definition of the services to be accessed and limited information being provided on school community profiles, there were some minor anomalies in the access rankings which became apparent when tested against local knowledge These anomalies served to emphasise that care needs to be taken in selecting the service access centres to which accessibility is to be measured

The model was first adopted by the Northern Territory Department of Education for the distribution of funding in the Country Areas Program within the Territory in 1993. This resulted in a significant redistribution of funding to the remotest areas.

Straight line distance was used in the 1993 model due to a lack of the information required to calculate the actual road distance into the distance element. The impact of the time/cost/distance unit in some areas in Arnhem Land and on the islands was therefore less than it should have been. However, even when straight line distance was used, the most remote areas of the Northern Territory received up to 24 percent more funding than under the national formula when applied to intra-Territory distributions. Informed comment from regional administrators and teachers suggest a greater satisfaction with the new model as it reflects the perceived access disadvantage of these school populations.

In 1994 the GSAF was further refined by using data which had just become available from the ABS 1991 Census and by using actual (rather than straight-line) distances to service access centres and incorporates differential weightings for sealed and unsealed roads. Incorporated for the first time were the time and cost sub-elements which allow population centres without road access or on islands to be accurately scored on a comparative basis with centres that have road access by converting the cost of air fares into a distance equivalent as previously described above.

A survey of education staff who have detailed knowledge of the schools and regions throughout the Northern Territory has been undertaken to test if the GSAF reflects to a statistically significant degree people's perceptions of the remoteness or access disadvantage of schools in the Northern Territory. The questionnaire asked them to rank schools in their region on the basis of their access to Darwin or Alice Springs, the two Territory centres with populations over 20 000 (see Map), taking into account actual distance, travel time and cost incurred.

SURVEY RESULTS

The objective of this survey was to test whether or not the GSAF remoteness component matched accurately people's perceptions of the time, cost and distance it took to get to a particular school and conversely for the particular school community to access the service access centre.

Of the 60 questionnaires sent out to those people with the knowledge and experience to complete them, 49 questionnaires were returned. This was a response rate of 82%.

SURVEY METHODOLOGY

Step 1

The first step taken in the analysis of the survey results was to determine the extent of the statistical correlation between the incoming questionnaires and the results generated by the GSAF. Because the data contained in the survey was of an ordinal nature, ie, ranked data, the Spearman's Rho test statistic was used to test for correlation between the GSAF results and each individual questionniare.

The Spearman's Rho test was conducted at the 0.05 level of significance testing these hypotheses;

Ho: There is no correlation between Xi and Yi

Ha: Either (a) there is a tendency for larger values of X to be paired with larger values of Y, or (b) there is a tendency for the smaller values of X to be paired with the larger values of Y.

Step 2

The second step of the analysis was to determine the overall correlation between a group of questionnaires from a particular region with the results generated by the GSAF.

In order to combine the rankings of individual questionnaire into one small ranking, principal component analysis was used The specifications of this analysis were standardised unit variance and selecting only the first principal component.

After one combined ranking had been obtained Spearman's Rho was again used to test the correlation between the grouped questionnaires and the GSAF.

This analysis was conducted for each of the six education regions within the Northern Territory.

Survey Results

Individual surveys

In all but 3 (of the 49) individual surveys one could reject the null hypothesis (Ho), that is, that there was no correlation between the GSAF and the survey results.

Regional Grouped surveys

In all 6 regions one could reject the null hypothesis that there was no correlation between the grouped surveys and the GSAF.

This indicates that there is substantial agreement between the perceptions of remoteness of schools as surveyed, and the method for ranking schools for remoteness, used by the GSAF.

CONCLUSION

One can therefore conclude that the GSAF reflects to a statistically significant degree people's perceptions of the remoteness of a school in every region surveyed. The GSAF is therefore a valid method to use when independently determining remoteness of schools within the Northern Territory.

The Northern Territory Department of Education has expressed confidence in the GSAF. The Department has adopted the model for allocating Country Areas Program funding and giving an access dimension to the distribution of Special Education and Professional Development funding in 1994. It is now under consideration for the English as a Second Language program.

The Commonwealth (Federal) Department of Employment, Education and Training is currently considering the GSAF as one of the options for the national allocation of funds in the Country Areas Program.

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