

Yield Management: Applicability to Education Services Sector

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Abstract: Yield management is credited with delivering increases in revenue of between five to seven percent for top tier airlines. Since that time, its application has been extended to other service sectors within the travel and tourism industry. However, its application in other service industries which have high fixed costs and little marginal cost for additional customers is still in its infancy or is yet to be explored.

The purpose of this paper is to introduce the fundamental concepts and trade-offs of yield management in the education services sector; as such we initially examine the components of yield management; describe yield management in the transportation and hospitality sectors; and finally, draw parallels with transportation and hospitality sector and explore its applicability in the education services sector. Beyond this, we look at a potential strategic application of yield management theory and concepts in increasing the disbursement of international students opting to study in regional areas of Australia. Examination of the limitations and barriers to implementing a yield management system in the education sector along with recommendations for further research are discussed.

Keywords: Yield Management, Operations Strategy, Educational Services.

I. Background

Yield management is a management tool used extensively in the travel and tourism industry to maximise revenue through differential pricing, the use of reservation and inventory management systems, and overbooking. Yield management is said to have its origins in the 1960's when American Airlines began using operations research for revenue management decisions [3]. Models that focused on booking limits and inventory control systems were developed [11]. It was the perishable nature of services being sold that drove the implementation of yield management in the service industry.

Education, whilst a different service industry shares many similarities to the travel and tourism industry and as Brinn suggests "*One industry's brilliant innovation often becomes the foundation of another industries evolution*"[4]. Consequently, an attempt to explore yield management and

its applicability to the Australian educational services sector is made.

II. Literature Review

Yield management in the context of the hospitality sector is defined by Reid as "the process of allocating the right inventory to the right customer at the right time, at the right price"[12].

By distilling this definition by Reid, it is determined that the components of yield management can be categorized into:

- The "right customer" – customer segmentation
- The "right time" – time based forecasting
- The "right inventory" – inventory allocation and capacity utilisation
- The "right price" – business rules aligning to differential pricing.

Next, we discuss each of the four components of yield management.

Customer segmentation

Customer segmentation is defined as groups of customers that share similar characteristics [6]. There are three components to customer segmentation, these are: (1) defining and grouping the characteristics of each group (2) applying a demand model and determining their attitudes towards a reference transaction (3) determining their willingness to pay [20].

Zhang and Kallesen introduced a demand model where customer needs were satisfied by a combination of attributes namely, customer need and price [20]. Underpinning Zhang and Kallesen's framework were three demand models. These are yieldable demand, priceable demand and market priceable demand. Yieldable demand is where the customer need takes precedence over price. Priceable demand is where there is a balance maintained between customer need and price, and accordingly customers have a preference for a product but will only purchase the product if the price is perceived as right by them. Marketable demand is where the customers have a need for the product or service, however, they will purchase the cheapest product/service available. It is to be noted that consideration to the "fairness of the

transaction” also forms part of the decision making process by the customer [20].

Time based forecasting

Time based forecasting is considered an important element of yield management [9]. In the first instance, historical data is obtained to enable time series analysis; second to predict future levels of business; and thirdly to be able to identify current trends and be able to respond to changing needs with speed and agility. Kimes identified the following internal and external functional parameters - quantifiable demand, price sensitivity, propensity to spend, booking patterns, booking lead times, duration of stay, check in and departure patterns [9].

Inventory and capacity utilization

Inventory is defined as the number of “units” of a product or representations of a product [13]. In the transportation industry, the application of nested inventory enables a class hierarchy to exist, that is, lower fares are a subset of higher fares within the same travel class. The term origin/destination inventory gave rise to the creation of services that include direct services or connect services. Connecting services may be provided with the same service provider or with different service providers. Different classes may also be combined enabling mixed class fares to be provided to customers [11].

Business rules aligned to pricing

Price differentiation is central to the exercise of yield management and as a consequence is a key component in maximizing yield. Brotherton and Mooney stress that pricing should satisfy the following three points: (1) pricing should be aligned to business strategy; (2) business should have the capacity and be capable of delivering differentiated pricing structure; (3) and that consideration should be given to market needs as well as market and competitor responses [5].

Given that business strategy must deliver in accordance with the firm’s long term objectives, as well as short term profits, pricing decisions should be made to balance both [10]. Implementing strategic pricing implies that the business pricing policies become more market driven than driven by the suppliers; delivering services based on market needs results in revenue increase whilst sacrificing sales volume; and pricing that is accessible to new market segments or changing consumer behavior is to a business’s advantage.

Point of sale hierarchy is a mechanism that enables the selective access to products, prices and/or inventory thereby enabling targeted and selective tactical marketing [19].

III. Framework

The literature review was conducted with over twenty (20) journal articles, text book chapters and papers. The analysis of these documents revealed that yield management is widely used by airlines and has been extended with use becoming common place within the accommodation sector as well. The literature review also examined service characteristics which enabled the components of yield management to be conceived in a generic sense enabled a framework to be created and then applied to the education services sector.

Services are permeating all aspects of industry including the manufacturing sector as they add value to business strategies. In the educational context, education adds value to the student by enhancing their knowledge and skills. In the current global environment of uncertainty, many researchers have concluded that it is the quality of human capital that helps a nation tide through rough times. It is for this reason that education as a service has been gaining rapid importance and there is a renewed focus on efficient delivery of this service to add maximum value to the end user the student and to those funding the study.

Services are defined generically as having four characteristics, they are intangible; heterogeneous; perishable; and production and consumption occur simultaneously [18]. Travel and tourism and education both fit into this definition. It is also possible to further segment services into three broad groups, these are; people processing; possession processing; or information based services [18]. Yip and Lovelock suggests that the following characteristics relate to people processing services: tangible actions to the customer in person; the customers travel to the point of service delivery; the customer remains there during service delivery; and the service provider maintains some sort of local geographic presence [18].

The framework assisted in the conceptual transition and confirmed that there were enough similarities between the tourism and education industries to warrant further investigation.

In an endeavour to unbundle the underlying concepts related to yield management in the hospitality sector, it has become apparent that services are delivered in a “space” and they are made up of “something” even though the units may be tangible and/or intangible. As with physical goods, where individual units can be packaged into different configurations and sold as new products, so to can services be grouped and packaged to form different products. These units are delivered to “someone”, “somewhere” who occupies “something”, in exchange of “money”. This analysis forms the framework outlined in Table 1.

Service delivery	Transportation	Accommodation	Education
Space	Plane	Hotel	College
Inventory units	Route, leg, segment	Floor	Qualifications, Modules, Units
Place	Cabin	Room	Classroom
Someone	Passengers	Guests	Students
Occupies	Seat	Bed	Place
Price	Fare	Rate	Fee
Notice of intention to utilize service	Ticketing date	Booking date	Enrolment date
Service delivery begins	Departure date	Check in date	Commencement date
Service delivery concludes	Arrive date	Check out date	Completion date
Conditions	Conditions	Conditions	Conditions

Table 1- Framework with parallels between transportation, hospitality and education services

Next we discuss the research methodology adopted for this research study,

IV. Research Methodology

This research study includes development of a conceptual framework through the use of a single case, case study with multiple units of analysis embedded in the case. Given the time constraints, and the availability and access to data, there was deliberation about the scientific validity of using this methodology. Further investigations into single case methodology found that Veal espoused the merits of this approach as “the single case is able to treat the subject as a whole, rather than abstracting a limited set of pre-selected features” [17]. As such, the framework for the education sector enabled generalizations to be made from the single case and can provide a means of which to test against the whole class [17]. The case study included multiple units of analysis that investigated the four components of yield management - customer segmentation; time based forecasting; inventory and capacity utilization; and business rules and pricing, as was identified in the literature review.

The research methodology adopted qualitative analysis of the case study through two facilitated focus groups and a number of informal interviews and discussions [15]. The first group included staff from the Faculty (Management and teaching staff at Technical and Further Education TAFE). The purpose of the focus groups was to identify computer systems used to record student data from the point of student enquiry through to their application, enrolment, attendance and course completion processes. This process also provided an avenue for determining data collection points, data storage, data mapping and data validation methods. The second focus group, included student administration staff. Staff represented where non-faculty aligned, non-teaching, administrative and management staff, which enabled

triangulation of the findings against the first group [17]. Additional external data was sourced from a number of TAFE information computer systems. These included system flow diagrams; and data from various operational and decision support systems for external validation purposes. Existing documents such as user manuals, marketing material and internal procedures were also used. For analysis purposes, the data collected was grouped into three broad categories namely, student data; course data and pricing data. .

V. Data Analysis

Based on the three data categories, data analysis was conducted on each of the four components of travel and tourism yield management applications in an attempt to assess similarities and differences with the education sector, and to illustrate how the application of yield management concepts can deliver value to the TAFE NSW Illawarra Institutes (IIT) international business strategy.

Customer segments

Student data was categorized according to four main characteristics: whether the students were domestic students; international students wanting to return home after completion of their studies; international students wanting to apply for migration on completion of their studies; and students with financial aid or scholarships. For the purpose of this case study, domestic students also included temporary visa holders such as working holiday and dependant visas. International students were deemed to those students holding a student visa subclass 520 English Language Intensive Courses for Overseas Students (ELICOS) and sub-class 572 Vocational Education Training (VET) visa.

The second set of data – the course data comprised of enrolment data from 2008 enrolments. (IIT) had 34,162 students enrolled across the Institute. Of these, 34,057 were domestic student and 105 were international students. International students comprised from the top five (5) markets, namely China, India, Thailand, Philippines and Vietnam. The examination of distribution channels showed that 50% of international students enrolled are “walk ins”, and are candidates generated from the local community. Given the significance and importance of the local community in sourcing students, the number of local students that were born overseas or those who nominated a different language other than English as the language spoken at home was also examined. Of the domestic students enrolled, 76% were born in Australia, 9% of students were born outside of Australia and 15% did not respond to the question. Further examination revealed that the 9% (3089) of students represented 91 different nationalities across 14 college locations. Wollongong was the only college where it

was possible to further examine nationality mix. Four (4) of the top five (5) nationalities for international students were shared by domestic students, these being China, Thailand, Vietnam and The Philippines [14].

Time based forecasting

Prior to examining time based forecasting, it is necessary to determine which courses are made available for delivery and why. The current process for course sourcing at IIT, is manual and is not currently based on any formal analysis. The current year's list is sent to Faculty Directors and Head Teachers to advise if they are able to offer the courses on the list in the following period. This process is flawed for a number of reasons - firstly, if courses were no longer going to be offered, the list would be ever decreasing year on year. Secondly, the course selection is subject to personal and peer bias and thirdly, there is no record maintained and therefore, transparency on why eligible courses may not be made available to international students. Finally, there is no structured process for assessing the eligibility of new courses that are available but not previously on the list.

Therefore, an evaluation of relevant data sources, data stores, data structures was undertaken in order to determine the usability of such data. Further, a structured and automated process to determine suitability of courses for offering to international students was designed. This resulted in a decision table being constructed in an attempt to desk check the possibility of partially automating this process as seen in Appendix 1.

Next, the time based forecasting method was reviewed; it was deemed necessary to examine the data across the enrolment funnel which is made up of six (6) discrete processes, namely:

- Enquiry
- Application
- Offer
- Acceptance
- Confirmation of Enrolment (CoE)
- Enrolment

A number of limitations existed that prevented meaningful forecasting and back casting of data. These limitations included the inappropriate use of "track and trace" capabilities; absence of an inventory management function results in a bull whip type effect within the funnel [13].

Detailed examination of the enrolment process at IIT identified that there were four (4) forms of enrolment. These have been identified as:

- Rolling enrolments
- Single course enrolments
- Multiple course enrolments
- Multiple course / multiple provider enrolments

This finding suggests that nested inventory within the education services sector is also relevant [11]. The application of nested inventory would allow places to be allocated to students part way through a course or enrolling in longer courses, thereby protecting future revenue.

Rolling enrolments enables students to enroll any time throughout the year. A single course enrolment provisions the student with obtaining one qualification from one education provider. Multiple course enrolments enable the student to gain two (2) or more qualifications with a single provider and a single course enrolment may be possible where lower level qualifications are embedded in higher level qualifications. Multiple course and multiple provider enrolments is feasible when the student enrolls in a course that has agreed and pre-arranged pathways and articulated arrangements with the more than one (1) education service provider.

Inventory and capacity utilization

The education industry and the Australian Quality Training Framework (AQTF) defines units of competencies (UOC) based on a specific job function defined as the specification of knowledge and skill, and the application of that knowledge and skill, to the standard of performance expected in the workplace, by AQTF [1]. A UOC is the smallest unit that can be assessed and recognised. UOC's are combined to create units and units are combined to form courses. The level of difficulty and complexity in content determines the level of qualification. Information from the Training Packages @ Work document identifies that industry is not concerned with the attainment of qualifications; rather they require units to be combined and delivered in skill sets [1]. Skill sets are a set of units that are combined in such a way that they meet industry needs, licensing or regulatory requirements and are a statement of skills and knowledge required to achieve a specific task [1].

The course data illustrated in Appendix 2 shows that each unit within a course has a maximum number of places allocated. The number of places may relate to the complexity of the tasks to be learned or due to occupational health and safety issues relating to the practical nature of the instruction hence the limit on the number of workspaces made available in the practical teaching rooms such as a kitchen. An example of this would be - Certificate III in Cookery limits the number of places available for practical work in the kitchens to fifteen (15) students, where as the instruction given in the traditional classroom style is capped at twenty (20) students. Therefore, whilst the inventory cap is fifteen (15), the realization of five (5) additional inventory units could potentially be realized for other units, if resources and marketing are planned appropriately.

Business Rules and Pricing

As identified earlier, price differentials are a condition of yield management. In order to determine the viability of being able to differentiate pricing it is necessary to look at the cost structure and cost drivers of course delivery. For modeling purposes the current costs (funding) structure is determined and then a new commercial model is applied with the strategic objective of guaranteeing the delivery of educational services in the respective region and to encourage the benefits of cultural exchange beyond the major cities.

Firstly, it is necessary to establish a basis on how costs for a course can be established. Then we look at a model for establishing a “break-even point” to cover the cost of delivery. i.e., establishing the fixed and variable components of course delivery without giving consideration to the number of students enrolled. From here it is possible to determine the minimum number of international students required to cover the cost of delivery. Next, we determine the maximum number of places that can be accommodated in each class (unit). This provides the maximum revenue that can be generated through the delivery of a particular course.

Break-even point analysis

Mainstream courses are delivered to domestic students on behalf of the State Government. This is administered by the Department of Education (DET), who determines the price it will pay each institute for each course based on a Resource Allocation Model (RAM). Here, we make the assumption that given the government is a “not for profit” organisation that the price paid by the government equals the cost of delivery. There are twenty six (26) RAM categories and three (3) levels within each RAM category. Different levels of funding enable different funding models for delivery in metropolitan, regional and remote areas. Each course has a number of nominal hours that is recommended to deliver each course. Funding is applied to the number of actual student contact hours (ASCH). Based on this model, it is now possible to apply a cost of seat for each course, ie. the amount that “someone” is prepared to pay for a student to occupy a seat in a class. In addition, there are overheads and administration fees which are excluded from this calculation as it is deemed that they are allocated to administration and do not contribute towards the funding of the educational delivery.

Therefore, the cost of seat (C_s) is equal to the Nominal hours (N_{hr}) multiplied by the dollar ASCH rate ($\$ASCH$).

$$C_s = N_{hr} \times \$ASCH \quad (1)$$

As government funding is only applicable to students enrolled to obtain a qualification, the “excess” inventory as described in the inventory and capacity utilization is still

deemed as available. Upon examination of the data, it was evident that eleven (11) units grouped into two (2) skill sets had the potential of generating an additional \$90,450. See calculations Table 1.

IIT operates fourteen (14) campuses located in regional areas of New South Wales. These areas have a decreasing population base of people between the ages of 15 – 24 years. This change in demographics has an impact on IIT being able to gain minimum numbers of students required to deliver some of the courses. Some locations also require seasonal workers – eg. Shoalhaven (Nowra) for summer beach holiday seasons and The Snowy Mountains (Cooma) in the winter for the ski holiday season.

As part of this research a yield management model which includes differential pricing in exchange for studying in a regional location is now referred to as the “prop-up business model”. Therefore, in order to determine the business model it is necessary to:

- Determine the current retail price and net selling price
- Determine the cost of delivery including fixed and variable costs
- Determine the break even point in terms of the number of international students required to cover the cost of the course
- Determine the number of international students that may be required to provide an attractive price incentive in order for the prop-up model to be viable

The calculations for the different variables were performed in five (5) sequential stages.

- Calculate the current net selling price (net income);
- Calculate the current amount paid to IIT from DET for domestic students (cost of seat);
- Calculate cost of delivery under a cohort delivery model (cost of delivery);
- Calculate the number of international students required to cover the cost of delivery at the current net selling price (break-even point);
- Determine the number of international students required to cover the cost of delivery with variable selling prices (yield management effect).

See Appendix 3 for details of the calculations.

VI. Results

As evident from the calculations in Appendix 3 the breakeven point for the “prop-up business model” is achieved with eight (8) international students in the class and that a price reduction of approximately twenty three (23) percent can be achieved by increasing the cohort group size

from eight (8) to ten (10). This would provide capacity for up to five (5) domestic students and accommodating the servicing in areas where “thin markets” exist.

In conclusion, the findings from this research have helped us establish a yield management framework applicable to the education sector. Secondly, the framework demonstrates the identification of the components and application of yield management to the education sector as originally applied to transportation and accommodation sectors. Thirdly, analysis of each component as applied to the education services sector and lastly, an attempt to conceptually apply yield management in education to deliver strategic benefits to regional colleges within TAFE NSW - Illawarra Institute as demonstrated in Appendix 4, where a potential application of Yield Management applied to marketing of educational services is demonstrated.

VII. Implementation and Issues

The literature review identified that successful implementation of yield management in the education sector was dependent on human factors as much as technical factors.[8] Technical factors such as systems, data aggregation, integration, storage and access to relevant historical data were all identified as gaps in the IIT case study. Whilst human factors were out of scope for this research project, observation throughout the study identified the need for new work practices and new job designs [7]. Skills demonstrating an ability to effectively use information technology, and a willingness and ability to apply forecasting techniques was also found to be lacking. The current key performance indicators, metrics and funding model used at IIT are at odds with concepts pertaining to yield management

VIII. Further research

The analysis supports the view that there are similarities between the travel and tourism sector, and the educational services sector. Based on this preliminary case study at TAFE, it can be affirmed that yield management concepts can be applied to the educational services sector. However, further research is required to validate and generalize across the various subsectors of the education industry. Also as the data collected, stored and provided for analysis was limited and often unstructured, what became apparent is that decision support capabilities within the education sector are lacking and thus, are preventing the education services sector from being competitive. More detailed research on customer segments and their price break points will provide insights into delivering a combination of skills sets as opposed to qualifications to meet customer needs and budgetary constraints. Further analysis on the study patterns of international student migration intentions when selecting

a course would enable more sophisticated profiling and this allow improved target marketing to students depending on their age, nationality, area of interest and migration intentions. Improved track and trace capabilities through the enrolment funnel would enable opening up course applications to domestic students in line with international students, no doubt, additional investment is required to undergo data and course mapping in order to enable the use of ICT and further technological advancements to the operations of student administration and the seamless interface between various education providers. Apart from the technical aspects, further research examining the cost / benefit and return on investment would need to be examined given the frequency and volume of students versus travelers and cost of service. Further examination of the economic and social impacts, and the implications of moderate numbers of internationals students studying in many regional locations has on local communities, businesses and students is recommended.

Appendices

Appendix 1: Decision support table to determine which courses may be offered for the following year

Decision Tree							3 year trend	Decision	Action
1	2	3	4	5	6	7			
Y	Y	Y	Y	Y	Y	Y/N	Up or down	Offer	Allocate places
Y	Y	Y	N	Y	Y	Y/N	Up or down	Offer	Allocate places
Y	Y	N	N	Y	Y	Y/N	Check trend	Offer	CRICOS register and offer
Y	N	Y	N	N	N	Y	Check State enrolment trend	Go/No go decision	Local trend analysis, check resources to run
Y	N	Y	N	N	N	N	Check State enrolment trend	Go/No go decision	Local trend analysis, check resources to run
N	N	N	N	N	N	Y	Check State enrolment trend	Go/No go decision	Refer to DET to negotiate with ISC

Appendix 2: Table showing UOC grouped by skill sets and maximum revenue potential by allocating inventory at a unit level.

DIPLOMA IN HOSPITALITY (10115)											
COMPETENCY NUMBER	COMPETENCY NAME	SKILLS SETS	Hhr	\$ ASCH rate	Cs	Course max	Total	Class max	Add capacity	Add yield	New Max yield
SITXCCS002A	Provide Quality Customer Service	A	60	13.5	\$810	15	\$12,150	20	5	\$ 4,050	\$ 16,200
SITXCCS003A	Manage Quality Customer Service	A	40	13.5	\$540	15	\$ 8,100	20	5	\$ 2,700	\$ 10,800
SITXCOM001A	Work with colleagues & customers		20	13.5	\$270	15	\$ 4,050	20	5	\$ 1,350	\$ 5,400
SITXCOM002A	Work in a socially diverse environment		15	13.5	\$203	15	\$ 3,039	20	5	\$ 1,013	\$ 4,050
SITXCOM003A	Deal with conflict situations		20	13.5	\$270	15	\$ 4,050	20	5	\$ 1,350	\$ 5,400
SITXGLC001A	Develop & Update legal knowledge requ	B	50	13.5	\$675	15	\$10,125	20	5	\$ 3,375	\$ 13,500
SITXHRM001A	Coach others in job skills		20	13.5	\$270	15	\$ 4,050	20	5	\$ 1,350	\$ 5,400
SITXHRM003A	Roster Staff	B	20	13.5	\$270	15	\$ 4,050	20	5	\$ 1,350	\$ 5,400
SITXHRM005A	Lead & manage people	B	40	13.5	\$540	15	\$ 8,100	20	5	\$ 2,700	\$ 10,800
SITXMGTO01A	Monitor work operations	B	30	13.5	\$405	15	\$ 6,075	20	5	\$ 2,025	\$ 8,100
SITXOHS002A	Follow workplace hygiene procedures		20	13.5	\$270	15	\$ 4,050	20	5	\$ 1,350	\$ 5,400
											\$ 90,450

Appendix 3: Calculations

Current Selling Price

The retail price is the current advertised price, less distribution costs, this provides the net selling price per international student. The calculation is as follows:

Retail price of 2 year course per international student	=	\$31,000
Less 20% distribution costs per international student	=	\$6,200
Net selling price per international student	=	\$24,800

Delivery costs

Fixed Delivery cost

- 20 hours per week X 18 weeks per semester X 4 semesters = 1440 total delivery hours
- Commercial rate (including cost of preparation, cost of delivery, on costs, infrastructure provision (rent) and mark up = \$115 per hour
- Therefore fixed delivery cost = \$165,500
- Variable cost = \$2000 per student for total delivery period
- Total delivery cost for 8 students = \$181,600 for 2 year period
- Selling price including distribution costs \$28,375

If there were 10 international students the total delivery cost would increase to \$185,600 (that is an increase of \$2,000 per student for variable costs) the net selling price to student is \$18,560. Gross selling price including 20% commission for agents is \$23,000 representing approximately 25% off the current selling price

Appendix 4 – Sample of the potential application of Yield Management applied to the strategic marketing of educational services



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Background of Authors

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Maira is the International Business Manager at TAFE NSW Illawarra. Her career has been primarily in services marketing and operations where she has been responsible for the support, product and business development of global reservation, distribution and payment related technologies She has also been involved in internet-based start up companies and on a number of strategic projects including the Australian Tourism Data Warehouse (ATDW).

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Renu has 29 years of extensive industry and academic experience. Renu has held senior management positions at the State Rail Authority of NSW, Telstra Corporation and its joint venture global company REACH. With her recent completion of her PhD, Renu was awarded the "ANZAM Best Doctoral Dissertation Award 2008" for her doctoral research titled "Drivers and outcome of elevated service offerings in a collaborative organisational environment" (A Framework for Service Value Networks (SVN)). Her specific research interests are in services, dynamic capability building, service value networks, innovation in services, and management practices and its impact on firm performance.