SUMMARY AND CONCLUSIONS

Conceptual Framework

The theory of human capital formation gave rise to several studies analysing the economic aspects of education and the contribution of education to the economic development. It, in fact, gave rise to new branch of economics, namely, economics of education. Several empirical and theoretical studies in the area of economics of education also indicated the limitations of the theory of human capital formation and the use of economic tools for the analysis of education. Notwithstanding these limitations, it was recognised that the branch of economics of education provided a lot of insights into the economic aspects of education and was found to be very useful for micro analysis. Some of the studies also suggested that framework of a political economy of education and from narrow paradigm of human capital formation, interdisciplinary and micro level studies are powerful and in the analysis of economic aspects of education, such analysis becomes essential when the resources are scarce and they need to be used optimally. The present study had been attempted under the framework of micro analysis with the objective of offering suggestions for optimal use of scarce resources in the area of higher education.
The Need of the Study

In the recent past there has been some developments in the mode of delivery of education. Among these in 60's a significant development was in the mode of delivery of education in the form of open learning system. This system, in its nature, is capital intensive and has wider scope of coverage and attempts to liberate educational processes from time bound conventional system. The economic rationale suggests that if this alternative mode is cost-effective, then while making investment choices in education this fact need to be considered. Besides, if a system is capital intensive and has different characteristics, it becomes essential to examine how efficiently the resources invested in the system are being used and what are the alternatives, within the system, which offer more scope for efficient use of resources. To throw light on these aspects, a need for an economic analysis of this new system was greatly felt.

Most of the studies on this system have been attempted abroad and studies on Indian open learning system were very few. This study, it was hoped, would help to fill the gap.

The study had addressed the following aspects:

1. What are the characteristics of the cost structures of the two systems i.e. the open learning system of higher education and the conventional university education system?
2. Are there any comparative cost advantage in imparting education through open learning system?

3. What is the definition of the Unit Cost? What is the per unit cost of imparting education through an open learning system?

4. Does there exist any size cost relationship or any possibility of reaping economies of scale at any given level of operation of an educational activity?

5. Can the internal efficiency of the system be improved by increasing the cost-effectiveness and making optimal use of internal resources?

The main objectives of the study were as follows:

I. to analyse the cost structures of the two prevalent systems of imparting higher education in India namely the conventional university system and the open learning system i.e. IGNOU (Indira Gandhi National Open University);

II. to discuss the limitations and scope of comparing cost advantages of open learning system and a conventional education system;

III. to compare the unit costs of education in open learning system with that of a conventional education system;
IV. to analyse the unit cost of the various academic and non-academic activities of the open learning system. (in particular, the Indira Gandhi National Open University).

V. to analyse the size-cost relationship and determine the optimum enrolment size of an educational activity of the open University for reaping the economies of scale, and

Hypotheses Examined

The study had tested the following hypotheses:

i. that functions of conventional and open universities are the same i.e. training, research and evaluation, but owing to difference in characteristics, the structure of cost and components of cost vary between these two modes of higher education;

ii. that unit per student input cost in open learning system is relatively less than in conventional education because of the presence of economies of scale in the former and the absence of it in the latter.

iii. that unit cost of educational programme in open learning system depends largely on audio, video and print mix of the teaching material

iv. that unit cost also shows the following characteristics because of heavy initial investment, fixed cost and indivisibility of educational inputs on: (a) the
educational programmes with low credits and low number of students have higher unit costs, (b) this unit cost falls as the credit and student number increases to a certain point; (c) beyond this point the unit cost again increases (due to lack of infinite divisibility of inputs and the need of a minimum fixed cost.) Thus the cost-size relationship in the open learning system ensures a classical 'U' shaped average cost curve.

**Concept of Open Learning System**

To begin with, the study had discussed the concept of open learning system. Some of the important definitions were used to explain the concept. Accordingly the open learning was characterised by: a) removal of restrictions; b) use of new technology; c) flexibility in terms of certain barriers like economic, educational, personal and spatial; and d) change in student-teacher relationship. The discussion on the concept of open learning system was further preceded by a discussion on a brief history of the genesis of open learning system in India. Such a discussion mentioned the various other alternatives of imparting education through distance modes which were prevailing in India, but could not really be encouraged much because of their limitations and drawbacks. For example, in late Fifties, some of the Universities have provided the system of external examinations. Under this
system, university did not take any responsibility of teaching, tutoring or guiding the students who appear as private candidates. As a result, such students, while preparing for their examination, depended largely on so-called "money making educational shops" i.e. tutorial coaching institutions. These institutions give low quality of coaching, provide substandard cheap and inadequate reading material/literature. Dr. Madhuri R Shah, Chairman of the University Grants Commission, commenting on this system observed that "It is one of the most unreliable and corrupt systems in the country and should be scrapped".

The other mode of distance education i.e. the system of correspondence courses was started to overcome the problem of low quality of education of privately appearing candidates. But the system of correspondence education suffered from its own drawbacks and limitations. The report of the Committee on correspondence courses called as Dr (Mrs) Vijaya Muley has highlighted the deficiencies of the working of the system of correspondence courses in India as: a) the second class system of education; b) do not provide science courses; c) continue with the same rigidities of conventional education system of admissions and examination; and d) based on one medium i.e. print only.
History of IGNOU

Considering the deficiencies of the system of correspondence education in India, an effort was made to find out an alternative system of distance education, which could meet the growing demand of higher education in an economical way. Hence, the recommendations regarding creation of a National Open University was made. As a result of which the Indira Gandhi National Open University came into existence on 20th September, 1985 by the Act of Parliament. The Act defined the objectives of the University as; to advance and disseminate learning and knowledge by a diversity of means including the use of any communication technology, to provide opportunities for higher education to a large segment of population and to promote the educational well being of the community generally to encourage the open university and distance education system in educational pattern of the country and to coordinate and determine the standards in such system. This is the genesis of the national open university in India. The University was given the status of a central University which has its organisational structure with President of India as the Visitor of the University.

IGNOU : Organisation and Academic Activities

The main authorities of the University were specified as Board of Management, the Academic Council, the Planning Board, the Finance Committee and the Board of Recognition.
The main officers of the university are the Vice-Chancellor, the pro-Vice-Chancellors, Directors, the Registrars, and the Finance Officers. The main academic activities of the university were defined as a) development of academic programmes; b) continuing and extension education and c) research. At present the academic activities of the university mainly consist of i) development of short term and long term academic programmes dealing with graduate and under-graduate level of education; ii) curriculum transaction through student support services; iii) production and distribution of course material; iv) admissions; v) evaluation and examinations. The university also provides certain academic services namely library documentation and computers. The non-academic activities of the University are defined as the activities of a) general administration; b) common services and general charges and c) estate management.

The university has so far set up eight schools of studies for organising various academic programmes. These schools are: i) School of Humanities; ii) School of Social Sciences; iii) School of Sciences; iv) School of Education; v) School of Continuing Education; vi) School of Engineering and Technology; vii) School of Management Studies; viii) School of Health Sciences.

The academic programme which have already been launched by the university are; 1) Bachelor's degree programme
(B.A. and B.Com.); 2) Diploma in Management; 3) Diploma in Distance Education; 4) Diploma in Creative Writing in English; 5) Certificate Course in Food and Nutrition; and 6) Certificate Course in Rural Development. University is in the process of launching a number of academic programmes in future. A few of them which are to be launched in the immediate future are: i) Bachelor of Library Sciences; ii) Diploma in Management (Module III); iii) Bachelor of Sciences; iv) Certificate Course in Computer Application; v) Diploma in Higher Education; vi) Diploma in Management Module-IV; vii) Diploma in Rural Development; viii) Diploma in Food and Nutrition; ix) Diploma in Child Care and Education; x) Master's Degree in Distance Education; xi) Diploma in Creative Writing in Hindi.

**IGNOU : Teaching and Evaluation Methods**

All these academic programmes are based on the credit system, where one credit is equal to 30 hours of study. Therefore, a four credit course would require 120 hours of studies. This would include all learning activities namely reading and comprehending course material, doing self-check exercises and assignment listening related to course, additional and supplementary reading and benefiting from tutorials.

The University follows a letter grading system of 5 point scale (A, B, C, D and E) where A indicates Excellent, B - Very Good, C - Good, D - Satisfactory, and
E as Unsatisfactory. It is essential for a student to obtain minimum D grade in both the assignments and terminal examination in each course. However, the integrated average of a student should be at least C for his/her successfully completing the course.

The University adopts a multi-media approach to instruction utilising components such as self-instructional print material, video, audio programmes and counselling sessions. In addition, the University will also be utilising telecaste in the near future for courses in Sciences and Technology subjects. The arrangements will be made to enable the students to undertake the practicals near to their place of study.

**IGNOU : Staff and Students**

The University at present has 749 staff members (as on 1.5.89). Out of which 655 are employed at head offices. Academic faculty constitute 20% of the total staff strength. Along with the above staff the University employs over 5000 part-time academic counsellors each year and, on average, 8 course writers for each course.

The University, at present, has nearly 53,000 students on roll for various programmes. The statewise distribution of student enrolment reveals that Delhi accounts for highest percentage of enrolment of students. Genderwise analysis of total enrolment indicates that of the total students
enrolled during the year 1989, nearly 79.8% are males and 20% are females. Agewise profile of student enrolment indicates that nearly 1/3rd (31%) of the total enrolled students belong to the age group 21-25. Another 26.5% belong to the age group 25-30. Nearly 12% belong to the age group above 40 years. The percentage of scheduled castes and scheduled tribes among the total enrolled students for the year 1989 were 2.6 and 8.5 respectively. Rest of the students belong to the general category.

**Review of Cost Studies**

The study, after discussing the concept of open learning system, the background history, the organisational and other academic aspects of the Indira Gandhi National Open University, made an attempt to review the literature related to the cost of open learning system in India and abroad. The Chapter III was mainly devoted to the discussions on literature on the costing of open learning system in India and abroad. A brief discussion on the same Chapter was also made on concepts of costs and categories of costs b) methodology adopted for conducting the study c) problem of collection of data and adjustments made for calculating the costs.

The review of Literature on costing of open learning system in India and abroad divided the related important studies into four categories namely studies discussing 1) the cost structures and functions of an open learning
system; ii) the limitations and scope of costing in an open learning system; iii) the cost implication of using different media in education; and iv) comparison of the open learning system to that of a conventional education system.

The discussion of costs was divided into: a) technical costs; and economic costs; b) fixed costs and variable costs; c) recurring costs and non-recurring costs.

The cost analysis of the Indira Gandhi National Open University was mainly based on the data collected from a) budgets of the university; b) some of the unpublished sources like accounts/records of the various schools/divisions of the university for the period 1986-87 to 1988-89.

For comparison of the costs of imparting education through Indira Gandhi National Open University to that of conventional education system at undergraduate level, the data regarding enrolment and expenditures during 1986-87 - 1988-89 were also collected from the University of Delhi and some of its constituent colleges. The sample consisted of two universities namely the Indira Gandhi National Open University and the University of Delhi and four colleges, namely, Miranda House, Kirori Mal College, Desh Bandhu Gupta College and Ram Lal Anand College. The School of Correspondence and Continuing Education was selected to represent the correspondence education within the
conventional rules and regulations in India.

The reasons for limiting the scope of the study to two central universities, four colleges and one School of Correspondence Education were: 1) the comparison of the cost was to be made between the universities having similar characteristics. The Indira Gandhi National Open University and the University of Delhi have at least two similar characteristics that both are Central Universities and both are located in Delhi. We also wanted to include Aligarh Muslim University for the purpose of comparing per unit cost of IGNOU to that of conventional Central University which runs all graduate as well as undergraduate courses. But could not do so because, inspite of trying our level best, could not get the complete data of enrolment for the latest years. ii) at the undergraduate level, the analysis of costing of conventional education was limited to only four colleges because: a) these colleges fairly represent the general as well as special characteristics of students of Delhi and b) supplied the complete information needed for our purpose.

The calculation of costs at some places involved adjustments and attributions also. But the aggregate per student cost in the chapter 4th and 5th are based on the actual figures of expenditures taken from the budgets/records of the University.
Open and Conventional Universities

Comparison of Structures

Chapter fourth deals with the cost structures of the two systems and highlights the limitation of comparing unit cost of the two systems, because both differ distinctively from each other. Since the characteristic features of the two systems i.e., the open learning and conventional education distinctively differ from each other, the cost structures of the two systems are also bound to differ from each other, and therefore, we cannot compare the unit cost of imparting education through an open learning system to that of conventional education system. It was argued that:

1. The two systems differ distinctively in terms of a) functioning i.e. teaching learning process b) norms regarding admissions, evaluations, examinations, c) developing, producing and disseminating the knowledge to students.

2. It was revealed that the conventional education system runs around the teacher and there is a given relationship between the number of student and teachers. The method of production and distribution of knowledge under this system is based on labour intensive techniques. In contrast, in an open learning system the knowledge development and production and dissemination takes place in a highly
impersonalised form of modern manufacture industry. The production process is based on the capital intensive techniques of production. In such a process of production there is a division of labour among the teachers who are actually associated with knowledge development and those who deliver the knowledge to students. In this system the knowledge is developed and produced by subject specialist (which include a group of academicians and by technicians and others. The production of knowledge (irrespective of number of students to be admitted) takes place at a large scale. The teacher, in this system, is related to students by media, and face to face teaching is substituted with prints, audio, video lessons.

3. The use of media becomes an inevitable component of the system, which calls for a heavy capital investment at the initial stages, thus changes the cost structure of an open learning system in favour of capital cost. Against this, the initial investment is not very significant in the conventional education system. Rather, the functioning of the system calls for increase in expenses with a corresponding increase in enrolment.

The argument could not be extended very far when the analysis of the given cost structures of open learning system and conventional education system was attempted. On the contrary, it was found that the cost structures of the
two systems in India had similarities inspite of having distinctiveness in their characteristic features. It was found that both the systems have mainly three types of costs, namely, a) direct academic costs, b) indirect academic costs, c) non-academic costs. The direct academic costs of conventional education system consist of a) teaching cost, b) teaching supporting costs and c) teaching inputs cost. Against this the direct academic costs of the open learning system consists of a) course material development cost, b) course material production costs c) course material distribution cost, and d) course material delivery/curriculum transaction cost. The indirect and academic costs of both the systems include basically cost of library and documentation and cost of computer services. Similarly the non-academic costs of both the systems consist of : a) cost of general administration b) cost of common services and general charges, and c) cost of estate management.

The argument became even more weak when we compared the expenditure pattern of the two systems represented by the two universities namely the University of Delhi representing conventional system and Indira Gandhi National Open University representing open learning system during the year 1988-89. We have taken the year 1988-89 only because the academic activities of IGNOU were very less before that year so were the expenses on academic activities. The university started functioning in terms of launching academic
programmes only from January 1987. When two programmes
(Diploma in Management and Diploma in Distance Education
were launched).

The expenditure patterns of the two universities during
the year 1988-89 were such that it was difficult to say that
cost structures of the two systems i.e. conventional and
open learning really differed from each other. In contrast
to this one finds quite similarities in the structure as
well as the expenditure patterns of the two systems. The
figure of the expenditure patterns of the two systems reveal
that the University of Delhi representing the conventional
education system spends 43% of the total budget on academic
activities, another 14% on academic services and nearly
1/3rd on non-academic activities. If we see the expenditure
figures of IGNOU, representing open learning system in India,
for the same year, we find that the pattern of expenditure of
this University is quite similar to that of the University
of Delhi. The IGNOU spends 46% of the total budget on
academic activities, 5% on academic services and 39% on
non-academic activities. Thus, one can conclude that the
similarities in given cost structures as well as the
expenditure patterns of the two systems i.e. (conventional
and open learning) in India at least do not support fully
our hypothesis that functioning of conventional and open
universities are the same i.e. teaching, research and
evaluation. But owing to differences in characteristics,
structure of cost and components of cost vary between these
two modes of higher education.

Comparison of Unit Costs

A comparison of unit cost of providing education through open learning system to that of conventional education system in India during the Years 1986-87 to 1988-89 revealed that the unit costs of providing education through open learning system was found to be less costlier than that of providing the education through conventional education system. The figures of per unit cost of providing education through both the systems indicate that the university of Delhi, representing conventional education system, spends between Rs. 9574 and Rs. 11978 on one student during 1986-87 to 1988-89 in awarding its degrees, diplomas and certificates. Against this, the Indira Gandhi National Open University, representing the open learning system, spend between Rs. 1911 and Rs. 1838 on one student during the same periodic 1987-88 to 1988-89 for awarding its degrees diplomas and certificates. The maintained colleges of the University of Delhi spend on an average Rs. 4158 to Rs. 5394 on one student during the period under consideration.

Although the figures of per unit cost of imparting education through School of Correspondence and Continuing Education during 1986-87 to 1988-89 were the lowest i.e. Rs. 667 and Rs. 821 among different alternatives, yet these figures are to be taken with caution because, these figures do not take into considerations many other non-teaching expenses which
are incurred by the University. Thus our hypotheses that unit per student input cost in open learning system is relatively less as compared to conventional education because of the presence of economies of scale in the former and absence of this in latter is proved by empirical data. Analysis also points out that as the characteristics of these two systems differ widely, therefore, comparison between the two suffers from several limitations. Therefore, this conclusion should be taken with a great caution.

Analysis of Unit Cost of IGNOU

After comparing the unit cost of providing education through various available modes of imparting education in India, an attempt was also made to analyse in detail the unit cost of providing education through the latest prevalent mode of imparting higher education in India i.e. open learning system represented by Indira Gandhi National Open University. It was noted that unit cost analysis has several limitations, yet it offers a very useful tool to find out internal efficiency in the use of resources. Therefore, keeping in view the limitations, analysis of unit cost was attempted for the University. The Fifth Chapter presented the analysis of the unit cost of the various aspects of the academic and non-academic activities of the IGNOU. The cost of academic activities include, programme development cost, cost of curriculum transactions/delivery
material production cost and cost of material distribution. The cost of non-academic activities include the cost of general charges and the cost of estate management. The university also incurs some cost on academic services like, library and documentation, computers, admissions and examinations/evaluation. This Chapter analysed the unit cost of these aspects along with the analysis of the cost of academic and non-academic activities of the university.

The main academic activity of the university i.e. programme development consist of three activities namely a) development of reading material, b) development of master copy of audio, and c) development of master copy of video. Thus the cost of development of an academic programme is mainly the sum total of the cost of the three activities mentioned above. The unit, for the analysis of programme development cost, is credit. Thus we have calculated per credit cost of development of an academic programme and its other components like reading material development cost, audio and video development cost. While calculating the per credit cost of development of an academic programme it was found that it was in the nature of fixed cost, and therefore, has to be distributed over the period of time for which the programme would continue. Since the life of an academic programme was fixed as five years the fixed cost of development of an academic programme was annualised and distributed over the five years period. It was also assumed that on an average at least 1/4th of the developed material
might be used even after completion of the five years thus in applying the formula of annualising the programme development cost, the calculations were made only on the basis of the 3/4th of the total fixed cost of the development of an academic programme while analysing the per credit cost, the two types of costs were calculated: per credit total cost of the development of an academic programme and per credit annualised cost of the development of an academic programme

**Per Credit Cost of Development of Programme**

It was found that the unit, per credit cost, of development of an academic programme, is determined by the nature and combination of the package of its academic inputs. This finding was based on the analysis of the unit per credit costs of developments of various academic programmes which have already been launched/developed and are being launched and developed. These programmes include various types, nature and combinations of academic inputs. For example the programme of diploma in management has more weightage of audio/video to reading material in its academic package. Not only this, the nature of audio, video programmes is such that, calls for an outdoor shooting, and specialised type of shooting which calls for high cost. Accordingly, the per credit cost of development of the
programme diploma in management is the highest i.e. Rs.71511. The annualised per credit cost of development of the same programme was calculated as Rs. 12732. It was followed by the per credit development cost of the programme Certificate Course in Rural Development. The per credit cost of the development and the annualised per credit cost of development of the programme of Certificate Course in Rural Development was calculated as Rs. 68967 and Rs. 12279 respectively. Both these programmes have relatively more weightage of audio/video components to that of reading material in the total package of academic inputs. Against this, the per credit total and annualised costs of development of an academic programme of Diploma in Distance Education was found to be the lowest i.e. Rs. 30655 and Rs. 5458 respectively. The lowest per credit development cost of this programme was due to: a) the development of reading material was totally by the internal faculty and b) relatively less percentage of audio and video component in the total package of academic inputs. Thus one reaches a conclusion that the per credit cost of development of an academic programme is determined mainly by: a) weightage of audio, video component in the total academic inputs and, b) nature of audio, video programmes in the packages of academic inputs. Although the method of preparation of reading material (i.e. the model used for development reading material) has also somewhat influenced the per credit cost of development of an academic programme, but was not found to be very significant determinant (except of
reading material) of the cost of development of an academic programme. The major determinants of the cost of development of an academic programmes were found to be: a) the weightage of audio and video components in the total package of academic inputs and, b) nature of audio and video programmes in the package of academic inputs.

While analysing the unit cost of the three components of programme development cost, it was found that unit cost of development of reading material is definitely influenced by the method adopted for the development of the reading material. The study has sufficient examples to support the conclusion. A few of them are mentioned below:

1. Universities in the beginning started developing reading material of two academic programmes by two distinctive methods. The reading material of the programme of Diploma in Management was developed by a method, under which all the units were written by the group of external experts/academicians. The role of internal faculty was to transfer the written material into the formats suited to open learning system. Against this, the reading material for Diploma in Distance Education was developed mainly by the internal faculty. A very negligible portion of the reading material was developed by the outside experts. The units were written, edited as well as formatted by the internal faculty. Now, if we look into the figures of the per credit cost of development of reading material of these
two programmes, we find that per credit cost of development of reading material (Rs. 9327) of the programme of Diploma in Distance Education is much less than that of per credit cost of development of reading material (Rs. 20477) for the programme Diploma in Management. The annualised per credit cost of the two programmes namely Diploma in Management and Diploma in Distance Education were calculated as Rs. 3646 and Rs. 1661 respectively. Hence, our argument that the per credit cost of the development of reading material is mainly influenced by the method of the development of reading material is supported by the facts. The preparatory and foundation courses of B.D.P. however are again exception to this phenomenon.

2. The data of the study have also supported the argument that unit cost of the development of audio/video is influenced by the number and nature of audio/video programmes. In fact, the per credit cost of development of audio/video strongly support this argument. If one looks into the figures of the cost of development of audio/videos for different academic programmes, one finds that highest per credit cost of development of master copy of audio Rs. 4351 and video Rs. 46680 were calculated for the programme of Diploma in Management. The reason for the high per credit cost of development of master copy of audio and video for this programmes were: a) the shooting was mainly of the nature of outdoor; b) external artists were hired; c) external studios were hired; d) specialist in specific
areas of management were approached for writing the scripts. Along with this, the number of audio/videos was also relatively very high for this programme. Thus, both nature as well as relatively high number of audio/video programmes lead to a high per credit cost of development of master copy of audio and video in the academic programme Diploma in Management. Against this, the nature of audio/video in the programme Diploma in Creative Writing in English is such, not much of the cost was involved. Some of the scripts were interview based, and help of internal faculty was taken in developing master copy of the audio and videos. As a result of audio (Rs.1071) and video (Rs.14245) were significantly less for the same programme i.e. Diploma in Creative Writing in English. The annualised per credit cost of development of master copy of audio and video for this programme were found to be Rs.191 and Rs. 2536 respectively.

**Unit Cost Delivery System**

In calculating the unit cost of curriculum transaction/delivery system it was found that the cost is influenced equally by number of students as well as number of credits and the behaviour of fixed and variable costs of curriculum transaction is not the same as expected in normal cases. The total cost of curriculum transaction was the sum of variable and fixed cost of curriculum transaction. Thus in principle the fixed cost should decline and variable cost should increase with an increase in the number of credits.
and students and the behaviour of the total cost should depend on the weightage of fixed and variable cost in a particular academic programme. In our case, both fixed and variable costs of curriculum transaction declined initially with an increase in number of credits as well as students in a given academic programme. As a result of which the total per unit cost of curriculum transaction is more for the academic programmes which have either less number of student or less number of credits or both. Against this the per unit cost of curriculum transaction is relatively less for the programmes which have either more enrolment or more credits or the both i.e. enrolment as well as credits.

It was observed from the figures of the per unit cost of curriculum transaction for different programmes (which had been launched) that the highest per unit cost of curriculum transaction (Rs.56.06) was found for the programme of Certificate Course in Rural Development. For this programme both the number of credits as well as enrolment was relatively less as compared to the enrolment and credits of the other programmes. It was followed by two programmes advanced Diploma in Management and Diploma in Creative Writing in English. For both the programmes, though the number of credits were more or less the same as that of the number of credits of the other diploma programmes, yet the enrolment was completely low. Hence the per unit cost of curriculum transaction for these two programmes namely advanced Diploma in Management and Diploma
in Creative Writing in English were calculated as Rs.52.52 and Rs.32.21 respectively. The preparatory and foundation courses of the B.D.P., though have less number of credits in each, yet a significantly high number of enrolment in each of these courses, as such the per unit cost of curriculum transaction figure is very low. Hence our argument that per unit cost of curriculum transaction is greatly influenced by both number of credits as well as the number of students is empirically supported.

**Per Credit per Study Centre Cost**

The analysis of the data also supported the argument that initial cost of curriculum transaction is determined by number of credits of academic programme to be launched and the number of study centres under operation, give a peculiar type of relationship of the per unit cost of curriculum transaction to the number of credits and number of study centres under operation of an academic programme. This relationship calls for a relatively low cost of curriculum transaction of programmes which have relatively less number of credits as well as associated study centres. The suitable example here will be an academic programme diploma in Distance Education, where per credit per study centre cost was calculated as Rs.804. The per credit per study centre cost will be high for the programme which have more number of credits as well as more associated study centres. The suitable example here is the programme for
Diploma in Management where per credit per study centre cost of curriculum transaction was calculated as Rs. 1495. The main conclusion drawn here was that per credit per study centre cost of curriculum transaction gives an idea about the initial financial commitment regarding delivery system of an academic programme.

**Per Block Production Cost of Print Material**

The production cost of reading material is influenced by the printing rates and the scale of production. It was found that the cost of production was high in case of those programmes where the rates of printing were relatively high and printing was done at a relatively small scale. In calculating the unit cost of production, we have taken into consideration the per block production cost of only some of the academic programmes which have already been launched and production of reading material for two programmes which have already been completed. The per block production cost for these programmes has been calculated by number of copies produced in the first instalment. The figures for per block production cost by programmes reveal that the highest production cost of one block (Rs. 19.20) was calculated for the programme Certificate Course in Rural Development. It was followed by Diploma in Distance Education for which the per block production cost was calculated as Rs. 15.83. The reasons for high cost of production of reading material for these programmes have
already been mentioned i.e. a) the printing was at the approved rates of the year 1986-87 which were relatively high and b) the number of copies printed at the first instance was less i.e. 1500 in the case of Certificate Course in Rural Development and 2000 in the case of Diploma in Distance Education. Against this the cost of production of one block for the preparatory and foundation courses of B.D.P. was calculated Rs.8.20. The production of blocks for this programme was done at the approved printing rates of the University for the year 1988-89 which were relatively low. The number of copies of each block printed initially was much high than that of the number of copies of each block printed for other programmes. Thus both the factors (i.e. low printing rates and large scale production) have attributed to relatively low per block production cost of Bachelor Degree Programme.

**Per Student Distribution Cost**

The distribution cost of the course material is influenced by the volume of course material as well as the number of mails sent to each student was also tested on the basis of the per unit cost of mailing course materials to students for different academic programmes. Data proved that the per credit per student cost of distributing course material for the programme of Diploma in Management was relatively high (Rs. 3.05). The reason was, volume of the course material was heavy. Against this, the per credit per
student cost of distributing course material for the preparatory course in mathematics of the B.D.P. was (Rs.3.00) not because of the high volume of course material but because of relatively more number of mails sent per student.

**Per Student Cost of Examination and Evaluation**

The average per student cost of examination and evaluation for the university during 1988-89 was calculated as Rs.64, and the average per credit per student cost of examination and evaluation for the same period, was calculated as Rs.3.76.

**Per Student Cost of Computer Services**

The average per student cost of computer services for the year 1988-89 was calculated as Rs.13.78. The per credit per student cost of computer services for the same year was calculated as Rs.0.20. For different programmes the per student and per credit per student cost is an attributed cost on the basis of number of credits and enrolment.

**Per Student Cost of Library and Documentation**

The average per student cost of library and documentation was calculated as Rs.10.80. The average per credit per student cost of library and documentation was found to be Rs.0.68. For different programmes these costs
are attributed on the basis of credits.

Per Student Cost of Admissions

On an average the University spent Rs.7.95 per student on admission of students during 1988-89. The per credit per student cost of admissions during the same period was calculated as Rs.0.24. For different programmes, the per credit per student costs are attributed costs.

Cost of Administrative Services

The calculations of cost of administrative services had taken into consideration the cost of general administration, cost of estate management and the cost of common services and the general charges. The university on an average spends Rs.375 per student on administrative services.

The per credit per student administrative cost for the university during the period under considerations was calculated as Rs.15.58.

Analysis of total Recurring Cost

The calculations of recurring cost takes into account the maintenance cost of the university. The maintenance cost consists of the costs of activities and services of the university which has already been discussed at length before. For recapitulation we may mention that these activities and services are: a) academic activities, which includes programme development, b) academic services,
which include library documentation and computer services, admissions, c) examination and d) non-academic services namely, administration, common services and general charges and estate management. The units of reference are the same that is per student and per credit per student.

**Per Student Recurring Cost**

Per student recurring cost for the university during the year 1988-89 was calculated as Rs.1727. Programme wise data reveal that the highest per student cost (Rs.4821) was calculated for the Certificate Course in Rural Development. It was followed by Advanced Diploma in Management (ADM) which had per unit cost as Rs.3411.

**Per Credit per Student Recurring Cost**

The average per credit per student recurring cost for the university was calculated as Rs.49 during the year 1988-89. Programme wise data reveal that the highest per credit per student cost (Rs.401) was calculated for the Certificate Course in Rural Development. It was followed by Advanced Diploma in Management and Diploma in Creative Writing in English.

The reasons for high per unit cost for these programmes were relatively less enrolment. Against this the preparatory and foundation courses had relatively low per student costs because of high enrolment.
Analysis of total Non-Recurring per Unit Cost

Non-recurring cost is the cost of capital goods, in the university, which include cost of a) books; b) furniture; c) fixture; d) studio equipments; e) university vehicle; and f) computer hardware. The per unit cost here is an annualised cost. The annualisation is done for 14 years at the rate of 6% interest on the basis of capital recovery.

Per Student Capital Cost

The per student capital cost for the university was calculated as Rs. 127. The programme wise per student capital cost was, however, attributed on the basis of the weightage of number of credits and number of students enrolled.

Per Credit per Student Capital Cost

The total per credit per student capital cost for the university was calculated as Rs.4.53. The per credit per student cost for various academic programmes is the attributed cost. The attribution is done on the basis of the weightage of enrolment and credits in respective programmes.

Analysis of Size Cost relationship

The Unit cost analysis revealed some sort of
relationship between number of credit and cost of development of programme, number of students and credits in a programme and unit cost. This also indicates some relationship between number of credits and number of students and the cost of delivery system. The analysis pointed towards presence of scale economies, i.e. the programme with lower number of credits and less number of students appeared to have a higher cost as compared to those programmes with higher number of credits and with higher enrolment. Therefore, conceptually basing our analysis on scale economies, defined as "Wherein scale of operations i.e. increase in all factors at the same time in the same degree i.e. when we double all the inputs, we may find that output is more than doubled. This phenomenon is called Returns to Scale". In our case, the per unit cost of educating the students or per unit cost of producing a programme is less if the size of programme and a student enrolled in that are relatively higher than in a programme which have low enrolment and a small number of credits. Hence, we have presumed that the University i.e. IGNOU to operate more or less on the lines of an industrial units. It has twenty different lines of operations (each with chosen scale) represented by its twenty academic programmes. A few of these have already been launched and another few are being launched within a very short period. In studying the size cost relationship we have proceeded on the observation that the input requirements as well as the objectives of these twenty different programmes are broadly
similar, though in actual practice, the fixed and variable costs incurred (and therefore the scale chosen) are very different. This led to our attempting two types of exercises. As a first exercise we have tried to find out one common approximately optimum scale for each of these twenty academic programmes, which now have different fixed and variable costs, and different scales of operations. Having discovered that an approximately optimum scale (giving us the lowest unit cost) did exist for the programmes, we tried to spell out through simulation exercise the corresponding sizes of enrolment which would fully utilise the optimum capacities implied by the scale in the respective programmes.

Accordingly, simulation exercises were done to project the per unit cost of various activities of the university for various possible sizes of enrolment. These exercises were done with the help of the value of Regression coefficient ($R^2$). The value of $R^2$ was derived on the basis of actual observations as stated above.

The size cost relationship was studied for the following activities of the Indira Gandhi National Open University:

1. per student cost and enrolment size
2. per credit programme development cost and size of the academic programme in terms of number of credits;
3. per student cost of delivery system and the size of enrolment;

**Per Student Cost and the size of Enrolment**

Per student cost is summation of recurring and non-recurring cost of imparting education through open learning system represented by IGNOU. In calculating the size cost relationship, per student cost was regressed on the number of students enrolled. The value of $R$ was found to be $\hat{R} = 0.815763$, which gave a significant negative relationship between per student cost and the size of student enrolment. The per student cost curve was derived as U shaped cost curve. The curve was derived on the basis of quadratic equation. The U shaped curve indicated that at the initial stages when enrolment is less per student cost is very high, as the enrolment increases, the per student cost declines, therefore, the curve is downward sloping to the right. Once enrolment per programme reaches 6500 there is an upward movement to the right in the per student cost curve. All this leads to a conclusion that 6500 enrolment per programme is an optimum level of enrolment size for utilizing the present level of investment at IGNOU. This optimum size of enrolment is calculated on the basis of the expenditure for twenty programmes. At this size of enrolment the per student cost is also lowest which indicates that infrastructural facilities are fully utilised.
The U shaped curve of per student cost of IGNOU does not go well with the L shaped per student cost curve of open learning system of other countries. The difference in the shape of the curve is due to the difference in the level of initial investment. The investment done in the open learning system abroad is at a very high level thus per unit cost keeps on declining with an increase in the size of enrolment. In the case of India the level of investment in the open learning system represented by IGNOU is not very high. As a result of which, after certain size of enrolment, the given level of investment/infrastructure facilities are fully utilised and any further increase in the enrolment leads to increase in the per student cost of education. That's how the U shaped per student cost curve is derived even in an open learning system in India.

Per Credit Cost of Development of an Academic Programme and Size of the Programme

Since the programme development is the major academic activity of the IGNOU an effort was made to find out the possibility of developing a programme with a lowest per credit cost of development. For this purpose we calculated the total cost of development of a programme and tried to find a relationship between the per credit cost of development of a programme with the number of credits. The relationship was worked out with the help of parabolic nonlinear equation. The value of regression coefficient $R^2$ was found to be 0.53 indicating a negative relationship
between the per credit cost of development of an academic programme and the number of credits in that programme. Then again we derived a U shaped per credit cost of programme development which shows that up to a certain point the per credit cost of development of an academic programme declines with an increase in the number of credits in the programme. But the cost starts increasing as the number of credits in the programme is more than 28. The conclusion which can be drawn here is that programmes with less number of credits (say 4 to 12) are not economical because the per credit cost of development of these programmes is very high. Against this the programmes having number of credits between 20-28 are optimum in the sense that their per credit cost of development is relatively low. If university plans to develop an academic programme with more than 28 credits again the per credit cost of development of the programme will be high. Thus, ideal size of the academic programme is a programme with 28 credits where per credit cost of development of an academic programme cost is the lowest.

**Total per Student Cost of Delivery System of IGNOU and Size of Enrolment**

The total cost is the sum of fixed cost and variable cost of delivery system. In studying the optimum size of enrolment for making the maximum possible use of given infrastructural facility of the delivery system the parabolic non-linear equation was tried. The value of $R^2$
was found to be 0.81 indicating a perfect negative relationship between per student cost of delivery system and the size of enrolment.

The per student cost curve of delivery system was derived as U shaped cost curve. The shape of the curve indicates that up to a certain point the per student cost of delivery system declines with an increase in the size of enrolment. Thus the optimum size of enrolment per programme for fuller utilisation of existing level of investment on delivery system for twenty programmes is 7700 number of students. The conclusion which can be drawn here is that unless and until university does operate with 7700 student per programme there will be an under utilisation of the present level of investment on the delivery system of IGNOU. Total programmes being 20 and the enrolment should be 154000 in the year 1988-89.

In studying the size cost relationship of delivery system the IGNOU and the enrolment per programme it was found that even the variable cost was found to be U shaped which was initially disturbing because variable cost in principle should increase with the size of enrolment. The U shaped of this curve indicates that at the initial stages even the variable cost declines with the increase in the size of enrolment. The probe into data showed that even the variable cost of delivery system had some hidden characteristics of fixed cost. Therefore up to certain point the variable cost also declined with an increase in the size
of enrolment. The suitable example here could be of counselling sessions which is a component of variable cost. According to norms of the University one counselling session is arranged for 60 students. Thus the per student cost of counselling session is high if number of students in a particular counselling session is less than 60 and therefore upto 60 students it behaves like a fixed cost but becomes variable in nature if the number of students increases more than sixty. Thus the conclusion which can be drawn here that per student variable cost of the delivery system of IGNOU does not behave like a normal cost curve. It is a U shaped which declines initially with an increase in enrolment size and than starts increasing. The U shaped of the per student variable cost of delivery system of IGNOU gives 7700 an optimum size of enrolment in each programme for making a fuller utilisation of existing level of investment on the delivery system of IGNOU. If the university operates with this size of enrolment the per student variable cost of delivery system of IGNOU is lowest i.e. around Rs. 59.

The per student fixed cost curve of the delivery system of IGNOU was also found to be a U shaped curve. The curve was derived by using parabolic non-linear equation. The value of R was found to be 0.8651. The shape of the curve indicated that the size of enrolment 7700 per programme would be optimum for the university for making fuller utilisation of the existing level of infrastructural
facilities of the delivery system. Again the cost curve is U shaped because of the relatively low level of fixed investment at initial stages on the delivery system. Therefore with the increase in enrolment the given infrastructural facilities are fully utilised and if enrolment increases beyond given size, new facilities have to be provided. That would call for extra expenditure and thus increase in the per student cost.

Thus our hypotheses that: Unit cost also shows the following characteristics because of heavy initial investment on fixed cost and indivisibility of educational inputs: (a) educational programme with low credits and low students (representing different scale of operation) have higher unit costs; (b) this unit cost falls as the credit and student number increases to a certain points; (c) beyond this point the unit cost again increases due to lack of infinite divisibility of inputs and the need for minimum cost. Thus the size cost relationship in open learning system ensures a classical 'U' shaped average cost curve borne out empirically.

To sum up:

1. that structure of cost between conventional and open learning system, but for the components of costs, does not vary much;
2. That unit per student cost of education in open university is relatively less than that of conventional university. However, because of differences in characteristics, unit costs between these two modes of education is not comparable;

3. The unit cost of an educational programme in an open university depends on the mix of audio, video and print material as well as models adopted for development of the programme;

4. There is a size-cost relationship of classical \( 'U' \) -shape type between per unit cost and size of enrolment and the number of credits in different programmes. The university would tend to use its resources effectively by operating at the optimum size of enrolment in an academic programme.

The micro analysis of unit costs and the size-cost relationship offered us greater insights into the scope of efficient use of resources available with the open university. It also helped us in identifying the limitations of a comparison of cost between conventional and open university.
Limitations and Suggestions for future studies

The study provides a broad comparison of the per student cost of an open learning system represented by IGNOU to that of conventional education system, represented by the University of Delhi. It was not possible in this study to compare the per student cost of different equivalent academic programmes of the two systems, due to non-availability of data on the related aspects. The reason was the initial stages of operation of IGNOU which has launched a very few of its academic programmes in the past. Thus a follow up study examining quality of output These system if conducted in the future may be very

The whole size-cost relationship is based on the students enrolment, which does not take into account the effectiveness of the system. What we have emphasised is the efficiency of the system in terms of optimum utilisation of internal resources. The reason of limiting the scope of the study to only this extent was the non-availability of data for the purpose of studying cost-effectiveness of the system. The university launched its first academic programmes only in 1986. The study refers to the period 1986-87 to 1988-89, which is too short to study the quality and quantity of output in terms of first divisioners, second divisioners, pass outs, failures and drop outs. As a result of all this we limited the scope of the study to the analysis of per unit input cost of education.
It is hoped that future studies would fill this gap. The size-cost relationship, have been studied for twenty different lines of operations (each with a chosen scale) represented by twenty academic programmes. The analysis was proceeded on the assumption that the input requirements as well as the objectives of these twenty different programmes are broadly similar, though in actual practice the fixed and variable costs incurred (and therefore scales choosen) are very different. This led to our attempting two types of exercises namely, a) finding out one common approximately common scale for each of these twenty academic programmes, which now have different fixed and variable costs and different scales of operations, and b) having discovered an approximately optimum scale (giving us the lower unit cost) trying to spell out corresponding sizes of enrolment which would fully utilise the optimum capacities implied by the scales in the respective programmes. Thus the present study only examines the internal efficiency of the system by analysing the size cost relationship. The main emphasis was to see, the extent of the utilisation of internal resources and providing the size of enrolment required for optimal use of the infrastructural facilities (given in the present scale of operation) of the University.

What is required is a more rigrous study to analyse the size-cost relationship in terms of economie of scale, or increasing returns to scale. This aspect can be studies in
future in the following two ways: (a) examine the changes in the unit costs due to increase in the scales of operations of IGNOU over a period of time; (b) a comparison of the unit costs of IGNOU which has relatively a smaller scale than that of, say, the U K Open University which has a very high capital investment. Such analysis would help in finding out to what an extent a decline in unit cost in either case can be attributed to the scale of operations rather than the internal efficiency in other scale-unrelated factor.
NOTES


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