
UNIT 15 ECONOMICS OF ODE

Structure

- 15.0 Introduction
- 15.1 Objectives
- 15.2 Education as an Investment and Consumption
 - 15.2.1 Economics of Education: Meaning and Definition
 - 15.2.2 Education as Consumption and Investment
 - 15.2.3 ODE as Consumption and Investment
- 15.3 Human Capital Formation and National Development
 - 15.3.1 Education and Human Capital Formation
 - 15.3.2 ODE and Human Capital Formation
 - 15.3.3 Production Function in Education/ODE
 - 15.3.4 Cost-effectiveness and Cost-efficiency
- 15.4 Different Types of Costs: Factors and Functions
 - 15.4.1 Types of Costs
 - 15.4.2 Factors Affecting Cost
 - 15.4.3 Cost Functions
- 15.5 Economies of Scale in Distance Education
- 15.6 Let Us Sum Up
- 15.7 Answers to 'Check Your Progress' Questions
- 15.8 References
- 15.9 Unit End Exercises

15.0 INTRODUCTION

Economic aspects of distance education form important component of any programme evaluation exercise either related to a particular academic programme, or all the programmes, or in evaluation of an institution or a system as a whole. The economic aspects of educational transaction help in understanding the effectiveness and efficiency of any educational programme. As we have seen in the preceding unit, when we go for evaluation of an academic programme, all the variables and activities involved in the **input, process** and **output** stages need to be examined for the effectiveness of each of these activities. These broadly include programme / course planning, design, development (including all the components of instructional materials like print, audio, video, assignment, home kits, CD-ROMs, etc.) and course implementation (including continuous assessment, tutoring and counselling, hands-on and practical experiments, term-end examinations, etc.). For each of these activities; one needs to calculate the costs so that the final unit cost of the programme (i.e. total programme cost) as well as the unit cost per student (for each of the activities as well as for the entire programme) can be ascertained. This will also indicate how best financial and other resources may be utilised if a parallel or an alternative programme offer is made in the future. We should also know the various aspects of cost-effectiveness and cost-efficiency, i.e. how much money had been spent and in what way; whether alternative models or ways of doing things would have reduced expenditure; and whether the objectives of developing and offering an academic programme have been met within the stipulated budget.

In this unit, we will however discuss a few concepts of economic aspects of education and their applications in general which shall give you a broad understanding of the economic perspectives of distance education. Costs of distance education, cost functions, cost analysis and economies of scale in a distance education programme. We begin with the general aspects of economics of education in section 15.2, which then are applied to economics of distance education (especially the calculation of costs) in the subsequent three sections of this unit. The cost of each component of a programme of education, especially the unit cost is an important indicator to judge the programme effectiveness. How effectively money should be utilised to achieve the programme objectives, how to economise both financial and human resources and yet ensure efficiency of the programme, are the key questions, among other things, that we would address in this unit.

15.1 OBJECTIVES

After completion of this unit, you should be able to:

- define the concept of economics of education;
- discuss the concept of (distance) education as consumption and investment and its contribution to human capital formation;
- distinguish between cost-effectiveness and cost-efficiency;
- analyse costs in distance education; and
- explain how economies of scale can be achieved in distance education.

15.2 EDUCATION AS AN INVESTMENT AND CONSUMPTION

Economic aspects of distance education, especially those related to costing form an important aspect of programme evaluation. Decisions relating to cost-effectiveness and cost-efficiency are crucial to programme effectiveness and its quality improvement. In this section, we shall discuss the basics of economic aspects of education such as education as consumption and investment, human capital formation, production function, and cost-effectiveness and cost-efficiency in education.

15.2.1 Economics of Education: Meaning and Definition

Economics of education encompasses the study of economic aspects of education. It is concerned with production and distribution of various types of education and training over (a period of) time (i.e. now and in future). On the one hand, it concentrates on how resources are allocated to educational institutions at various levels, and how benefits or returns are received by individuals and the society from such an investment. On the other hand, it focuses on the study of the economics of human resources and educational planning, decision-making, investment and the growth and development of an educational system. By so doing, economists and educationists study the impact of education on various socio-economic aspects of recruitment and promotion, occupational structure of labour force, migration of labour, international trade, distribution of resources, savings and investment, economic growth and development, and the like. To be precise, it deals with deployment of scarce productive (human, non-human, financial) resources across various educational ladders (from literacy to higher education and research) and their distribution amongst various individuals and groups of a given society and the nation.

In the early 1960s, the study of economic aspects of education acquired greater significance; and it was realized that human resource development which directly depends on education and training of people is very crucial to the economic growth and quality of life. The developed and the developing countries of the world realised that education was crucial to and had direct bearing on both economic *growth* (in the developed countries, it refers to the increase in GNP/ per capita income of people) and economic *development* (in the developing countries, it refers to fundamental changes in the structure of production, like industrialisation, urbanization and from backwardness to development).

Education and economics are interdependent. While economy provides resources for educational development, education contributes to manpower development so needed for economic modernization and socio-cultural transformation. Education and training equip individuals with higher knowledge and skills, which are essential for higher mobility and productivity. Therefore, people generally choose to invest on their own and their children's education depending on their capacity to afford, besides spending on the basic necessities of life like food, clothing and shelter. However, at the national level, unless there is parallel development in the economy it becomes difficult to ensure resources for educational development. Once the level of economic activity rises, the national income increases, the fiscal capacity of the country improves, and the nation is in a position to invest on educational expansion and diversification. Studies such as Nelson and Winter (1982), Freeman (2002), Lundvall (2011), Kruss et al (2015), among others, have shown that expansion of education across various levels leads to economic development (i.e. increase in quantity and quality of production, technical and managerial skills, quality of labour force, and quality of life). International studies (e.g. McMahan, 1999) suggest that countries which are economically advanced have a very developed system of education and training. This suggests there is reciprocal relationship between education and economic development.

15.2.2 Education as Consumption and Investment

Consumption, in economics, refers to use of goods and services (and their utility) to satisfy wants; and investment usually refers to excess of production over consumption. Production and consumption of goods and services take place at the same time; and if production is more than consumption, there is surplus or accumulation. Investment in non-durable goods and services, like human beings, is essential for long-term purposes; and long-term investment is essential for future production. Education is considered both as consumption and as investment. Education is also a private consumption, because people spend on it for acquiring qualifications and training. It is also public consumption, in so far as the government spends huge amount on the education system itself. Expenditure on education is an investment in the sense that the individuals, the society and the nation as a whole derive future benefits out of those educated.

Regular education is clearly consumption, since individuals spend their earnings and government spends taxes collected from individuals for future benefits over a long period of time. On-the-job training (especially short-term training) is largely investment, since it is concerned with development of skills required for immediate use or benefit. In so far as educated persons get employment or productive work as per the level of their education, it is clearly investment — the present consumption leads to investment in future.

15.2.3 ODE as Consumption and Investment

In sub-section 15.2.2, while examining the concept of economics of education, we have talked about education as investment and consumption. In this section, we shall focus on distance education as consumption and investment, particularly for the large scale formation of human capital. This broad understanding shall facilitate you to grasp the application of costing of distance education presented in the subsequent sections.

Distance education is both as consumption and investment. It is consumption in so far as it consumes private and social expenditure on education and as long as it contributes to satisfaction of the human curiosity for more knowledge. But, clearly it is also investment because of its long-term benefits and the benefits derived after the completion of the gestation period. Investment in education raises individual productivity and earnings. Distance Education, as one of the modes of providing education, also increases productivity and earning especially when the educational contents/programmes are based on the immediate professional needs of its clients. The argument in favour of distance education is strengthened when investment considerations are judged within the framework of a cost-benefit analysis or simply within a costing framework.

Distance teaching-learning takes place in a non-contiguous situation, without the immediate supervision of teachers and teaching takes place through pre-produced course materials (print and/or mechanical or electronic devices). Contiguous educational arrangements are costlier than distance education — the latter is about one-fifth of the former in India. Further, formal education opportunities have limits with regard to equity of access, quality and equality.

Distance education has the inherent potentiality and possibility of providing greater access and taking care of equality of educational opportunities with lower cost. The use of latest communication and information technologies (ICTs) has made it possible for distance education not only to reach larger number of learners and provide need-based education but also to meet the continuing professional development needs of a variety of professions including medicine, computing, engineering and technology, teaching (education) more effectively. This, however, has to be understood within the framework that sufficient care is taken and sufficient investment is made to take care of the quality of materials and processes involved in this non-contiguous learning. Distance education is potentially media-savvy, and several media like print, audio, video, radio, television, counselling at recognised study centres and web centres and the like enrich independent learning at a distance. The methodology judiciously combines these media so as to reap maximum benefit towards effective and active learning. This methodology has been effective in imparting literacy and extension programmes as well as skill-based higher professional development programmes.

While education in general is an investment, distance education facilitates this more by broad-basing the access to higher and further education so needed, especially in a welfare society like ours. When continuing professional development, flexibility in course combination and educational placing are taken into consideration ODE stands out as a singular competitor for the twenty-first century. It has the added advantage of taking all the latest technological developments along with it.

The present mainstream higher education is facing the challenges of access, quality, relevance and resource constraints. ODE, the world over, has been poised to take on these challenges successfully and, at times, has got into both debates and applications for reforming higher and further education *per se*. The most important argument in

favour of ODE is that one can study through this system while being in full-time gainful employment, or unable to pursue higher education because of not getting the admission into conventional institutions or because of other constraints such as lack of adequate time, money, mobility, etc.

Check Your Progress

Note: a) Write your answer in the space given below.

b) Compare your answer with the one given at the end of this unit under “Answers to ‘Check Your Progress’ Questions”.

1) Describe how distance education is considered as investment.

.....
.....
.....
.....
.....

15.3 HUMAN CAPITAL FORMATION AND NATIONAL DEVELOPMENT

In India, constant efforts of national as well as state planning through various Five Year Plans have led to significant development of physical (infrastructure) and human capital, though the former has grown faster than the latter. Education is an important variable contributing to formation of human capital — at the early childhood through adulthood and at the later stages of life. Education is viewed from the stand point of lifelong learning, making all the available resources in the society a party to learning experiences of individuals.

15.3.1 Education and Human Capital Formation

Capital refers to assets which generate income in future. Physical capital includes equipment, machinery, buildings and the like which have productive capacity. Human capital has both quantitative and qualitative dimensions. Quantitative dimension refers to number of students studying, the proportion of people getting employment or even the number of hours needed to complete a task. Qualitative dimension refers to varieties of skills, extent of knowledge, level of attitude, aptitude and other attributes of human personality that affect the productivity of human beings. Effective use of physical capital depends on the quantity and quality of human capital deployed in performing different tasks in different fields. However, factors like education, health services, on-the-job training, housing and sanitation, modernization of technical education, mobility of workers, and the like determine the quality of human capital and its ability to do productive work.

Education and training are considered to be important part of human capital; higher the level of education/training, higher is the level of quality and capacity of people to generate, preserve and disseminate knowledge and technical know-how. Education and training contribute to better handling of the job or work at hand. It also contributes to inculcation of scientific temper and values so essential for making decisions most appropriate to achieve the set objectives. Further, education and training lead to

enhancement of the ability to innovate which is most essential for modernisation and increase in productivity.

The level and the content of education determine the formation of human capital, i.e. the level and the extent of acquisition of new knowledge, skills, experience and attitude by the workforce. Higher level of education and training contributes to development of managerial, entrepreneurial and administrative skills needed for directing the effective and efficient development of human capital for maximizing productivity. Human capital formation is a continuous and time-consuming process. It takes a longer period of time to produce or train an engineer, doctor, manager or a teacher. This process is influenced by many factors including food, clothing, shelter, educational facilities, and other resources (both individual and social) for pursuing education, and, above all, the attitude and willingness of people to undergo such a long-term exercise. The level of human capital formation through education is indicated by the level of educational attainments (i.e. the ratio of educated persons to total population of successive levels of education), and the ratio of labour force at various levels of occupation to total population.

15.3.2 ODE and Human Capital Formation

ODE assumes greater importance in the context of augmenting human capital formation in order to raise the productivity of physical capital further. The mechanism of ODE, as different from that of classroom-based education of conventional system, involves team work, pre-produced courses, and multimedia instructional delivery. On the one hand, there is the use of print, and audio and video media, and on the other hand, occasional or regular face-to-face contact facilitates, group discussion, individual-based and group projects, and hands-on practices for skill development. However, largely, a good part of teaching and learning takes place at a distance (in both space and time).

ODE helps in the expansion of the delivery of knowledge to a large mass at a lower cost in open and flexible manner. Updating and upgrading of knowledge is possible through continuing professional development programmes offered at a distance. The large scale use of audio-visual and video media (and even teleconferencing) in distance education, notwithstanding which takes care of development of skills through visual demonstrations, there is a need for greater physical participation of tutor/mentors and learners for learning the effective application of skills. Further, ODE is very useful in the effective utilisation of leisure time for part-time learning in the areas or subjects of one's own interest, choice and satisfaction. It also fulfills the pursuit of profitable hobbies linked to learning while earning, and earning while learning. In addition, ODE contributes to educational equality and to the idea and practice of lifelong learning/education, which requires largely non-formal education classroom, and for which community learning resources should be put to maximum use.

15.3.3 Production Function in Education/ODE

Economists employ production function as a theoretical construct to analyse the effectiveness of decisions on resource allocation. The possibilities of production in a firm depend on the relationship between its inputs and outputs, i.e. how maximum output can be achieved from a given set or combination of inputs. Similarly, production function, in an educational system, also refers to the input-output relationship. Educational productivity, which is the concern of all of us, is the present educational output (graduates, educational materials, innovative methods and media, better

management styles, and the like) obtained from the human, financial and material resources deployed in the past. The relation between total educational output and the total educational input at a particular period of time is the *average productivity of education*; and the relation between incremental output resulting from an additional unit of educational input is the *marginal productivity of education*.

The production function in education is, thus, the process which explains the relationship between educational inputs and educational outputs. The inputs in the context of ODE can be: number of teachers and other staff, number of students, size of the institution, the instructional process, teacher-student ratio and interaction, instructional materials, commenting and grading on assignments, academic counselling provided at study centres, and more importantly the private study of the distance learner. What do you think about the outputs? Obviously, one variable that comes to mind is the graduates (those who pass out from the system/institution). Other outputs may include the ability of personnel to apply knowledge and skills in their profession, their vertical professional mobility, their future earning profile, and the like. In distance education, especially, certain activities like course design and development and production take place before students are admitted. Therefore, these outcomes are considered as outputs also. Production function in distance education would then mean the process through which the fixed quantities (and qualities) of inputs are transformed into outputs, in either quick succession (like course materials) or over a period of time (like graduates) which are essential for economic development and socio-cultural transformation. The process through which this transformation takes place is largely invisible in distance education (which though is largely around then and there in contiguous learning situations). Student learning is the centre of all activities in distance education, and this learning process is unknown to many of the people involved (i.e. the teams in this industrial process of distance education).

For programme evaluation, therefore, it becomes essential to look into these invisible *processes* so as to be able to relate these to the economic aspects and draw meaningful conclusions. Though quantitative indicators and data are essential, it is the qualitative data (i.e. quality of learning and quality of services provided to facilitate learning) which are crucial to have deeper insight into and improve upon the processes in future. As you have seen in Unit 14, evaluation on the basis of only accountability perspective, and quantitative data through surveys and questionnaire analysis would be inadequate to explain the phenomenon under investigation. Even costs, when studied in isolation would be misleading and they need to be studied in relation to the process, i.e. quality of students learning and quality of services provided so as to be able to draw meaningful findings and recommendations.

15.3.4 Cost-effectiveness and Cost-efficiency

As we have noted in the introduction to this unit, both cost-effectiveness and cost-efficiency are crucial to economic analysis, and programme evaluation in distance education as well. Cost-effectiveness refers to achievement of pre-stipulated objectives within the given amount of physical, human and financial resources, whereas cost-efficiency implies achievement of the given output with reduced cost or increasing the level of output within the given cost. If we are able to produce multimedia learning packages in time, admit students and distribute material in time, organise counselling and continuous evaluation properly, provide guidance to students effectively and as per their satisfaction, conduct examinations and declare results in time (and also award degrees in time) — all within the given level of expenditure and as per the pre- specified

performance indicators for all types of activities — we are supposed to be cost-effective in our operations. On the other hand, if we can achieve greater efficiency and more output within the given time and cost, or if we can achieve the same objectives/output with less time and reduced cost, we are supposed to be cost-efficient.

For evaluating the activities (and allied areas) noted above, separate instruments are required to be administered on a variety of categories of samples. Cost-effectiveness and cost-efficiency are often overlooked while undertaking evaluation exercises; these not only tell us how to economically spend resources or how to make decisions for effective alternative uses, but also indicate the *level of efficiency* of instructional and human resources at our disposal which is so crucial to increasing efficiency and output of the organisation or the system.

Check Your Progress

Note: a) Write your answer in the space given below.

b) Compare your answer with the one given at the end of this unit under “Answers to ‘Check Your Progress’ Questions”.

2) Describe briefly the contribution of education to human capital formation.

.....

.....

.....

.....

.....

.....

15.4 DIFFERENT TYPES OF COSTS: FACTORS AND FUNCTIONS

In the evaluation of educational programmes and the efficiency of the system, it is important to estimate how much money we spend and how economically this is utilised in achieving the programme objectives. The basis on which these analyses can be undertaken is ‘unit-cost’, i.e. cost per student or per any other unit. Before getting to know the various factors affecting the cost of distance education and calculate these costs, let us look at various types of costs used in the economic analysis of distance education.

15.4.1 Types of Costs

Cost types that are discussed in education or distance education have been borrowed from both accountancy and economic theory. In accountancy, cost types such as labour cost, marginal cost, capital cost, operating cost, direct cost, indirect cost and the like are used. On the other hand, in the case of cost analysis derived from economic theories, there are the cost types such as fixed cost, variable cost, average cost, marginal cost, total cost, and the like. In the case of cost analysis for education or distance education, the second category of costs is used for cost calculation and comparison across institutions, systems and national boundaries. These cost types are as follows.

Fixed and Variable Costs

In costing of educational systems, costs can be classified broadly into two types: fixed costs and variable costs. **Fixed costs** are those which do not change in spite of changes in the volume of operation of the system and **variable costs** vary along with the volume of activity or production. Say, for instance, in the campus-based education, capital investment in the construction of buildings involves fixed costs, while costs involved in their maintenance every year refer to variable costs. These variable costs depend on the volume, i.e. number and size of classrooms, lab, library, hostels and the like. Fixed costs are usually one-time investments incurred by educational institutions for all those involved in the system. Further, these costs cannot be assigned to any group of clients or users part by part, though they can be apportioned for various categories of people or activities for calculation of unit cost. Fixed costs are also called as *non-recurring costs*.

While fixed costs are independent of the scale of operations of the institution, variable costs depend on the scale or volume of particular activities. These costs depend on the variable factors in the operation of the system or the process. Expenditure incurred on salary of permanent teachers is a fixed cost (which does not depend upon the number of students enrolled in a particular grade) whereas expenses incurred towards purchase and use of chemicals in the laboratory, for instance, are variable costs which depend on the number of students. These costs are recurring in nature, and are determined by teacher-student ratio, building capacity, nature of courses, and the like. Therefore, it may be said that these are the segments of costs which are affected by the volume of students and other related factors.

In distance education, capital investments are fixed for a longer period of time, so also is the salary of permanent faculty and staff which is paid irrespective of the number of students enrolled. Fixed costs are also extended to such items like development and production of the camera-ready copy of print materials or the first copy of audio-video programmes. These costs are incurred whether one or one hundred thousand students get(s) admitted to a particular programme. But, when these prototype materials are replicated and produced on a mass scale, depending on the number of students, these very items become variable costs.

Average and Marginal Costs

Broadly, two types of cost are used: total cost and unit cost. Unit cost is used for better understanding and comparisons, within and across institutions. Unit cost may be based on cost per one unit – student, course, programme, credit, etc. Cost per student may refer to cost per student enrolled, or per student continuing the course or per graduate. Usually, in cost comparisons, cost per student enrolled is taken into consideration. There are two ways of measuring the unit cost of students enrolled: average cost, i.e. cost per student enrolled (measured by dividing the total expenditure by the total number of enrolled students), and marginal cost, i.e. cost per an additional student enrolled, other than those enrolled earlier (measured simply by additional costs incurred when one additional student is enrolled).

The relationship between cost and size of the unit determines the variation of the relationship between average and marginal costs. When the enrolment increases, the total cost will obviously increase, but average and marginal costs may behave differently in this situation. This is due to the very nature of fixed and variable costs in educational institutions. Let us see this point through an example.

Let us assume that there are 1000 students admitted to a particular distance education programme, and the institution has incurred Rs.50,000 for the programme (Rs.30,000 fixed cost and Rs.20,000 variable cost). The average total cost would be Rs.50 (total cost divided by total number of students); the average fixed cost would be Rs.30 (total fixed cost divided by total number of students), and the average variable cost would be Rs.20 (total variable cost divided by total number of students). Let us assume further that the institution or department/school concerned incurred an additional total cost of Rs.200 for enrolling an additional student. This, then, affects all types of costs: the total cost increases to Rs.50,200, out of which Rs.30,000 is fixed cost and Rs.20,200 is variable cost. However, the average costs would show significant variations: in this case, the average fixed cost would be Rs.29.97; average variable cost Rs.20.18; and average total cost would be Rs.50.15; while the marginal cost remains at Rs.200. You will notice that while there is a decline in average fixed cost and the average total cost, the average variable cost has increased. Therefore, the change in marginal costs depends on whether the major chunk of cost is fixed or variable, and whether resources are utilised to the maximum and additional students can be enrolled and accommodated within the existing cost without incurring additional expenditure.

15.4.2 Factors Affecting Cost

The operation of any distance teaching institution (DTI) involves various cost centres and cost items which can be either variable cost or fixed cost. The major heads of operation include course design and development (both print and non-print packages), publicity and admission, material printing and distribution, student support services, and evaluation and certification. For the operation of different sub-systems in the institution a major variable which takes away about 40-50% of total expenditure is salary. (This, though significant, has to be compared with the campus-based system where salary shares about 95% of the total recurring expenditure). The major factors which affect the cost of ODE include the following.

i) Number of Courses on Offer

The larger the number of courses offered by a DTI would mean higher the design and development the bigger the costs. The course materials may include print, audio, video and allied materials, and the development of these involves fixed costs irrespective of the number of students. Cost due to this factor increases especially when students are provided with wider choice of optional courses. Costs also encompass implementation of the programme, the evaluation, and course maintenance and revision.

ii) Process of Course Development

As you may already know, the course team approach to course design and development followed at the British Open University has resulted in the involvement of huge expenditure in comparison with other approaches to course development, though it has contributed high quality course materials. The processes involved, time taken, number of people involved, their level of expertise and specialization, and the like affect the total expenditure. There are other methods like individualised training and development of courses by individuals, training for and development of courses at workshops, and so on which involve less resources than the course team approach does. Further, decisions like development of fresh courses or adoption of already developed courses, translation of courses into other languages or fresh development of courses on same topic in other languages, and use of full-time or part-time faculty affect the total and the unit costs of the programme and institution. Since cost of

human beings involved in course development is quite high it is the use of part-time faculty which reduces the total cost.

iii) Use of Faculty

If a DTI uses the services and expertise of part-time faculty on a large scale, as is the case with the British Open University and the Indira Gandhi National Open University, the total and unit cost get reduced considerably. The full-time faculty recruited on a permanent basis for the development of a fresh academic programme leads to the increase of the cost of the programme but the faculty contributes also to its maintenance and take care of future unit cost of the programme (in the absence of any major course development work of the permanent faculty). Many DTIs have been able to reduce the total cost and achieve economy of scale by hiring the services of experts on part-time and consultancy basis. Alternatively, as in the case of Australian Universities, the full-time campus-based teachers also teach distance students, and thereby contribute to economise the recurring expenses.

iv) Student Enrolment

If the institution considers student enrolment as an outcome, increasing enrolment, though increases variable cost, reduces the unit cost (per student cost), since the fixed cost gets distributed over an increasing number of students. Because of this reason, a DTI is able to enhance the quality of course design and development processes (including higher payment to course writers, editors, instructional designers, media specialists) and thereby enhance the quality of course packages at an extra cost since this gets distributed over an increasing number of students. On the other hand, it becomes difficult to invest more on these processes, if it becomes clear at the beginning that only a few (a selected group of) students would take up the programme, once on offer. Therefore, to reduce the overall programme cost, either the enrolment has to be increased or there has to be an increase in student fees. When student enrolment is low, it leads to lower variable cost, but on the other hand, in a situation of increasing student enrolment the economy of scale is possible if some of the expenditure heads under the variable costs are shifted to fixed costs.

v) Choice of Instructional Media

Most of the DTIs in India and presumably in other countries use only the print media, in the form of self-instructional print materials, for distance teaching-learning. A few like the Central Radio and Television University of China and the Athabasca University of Canada use largely non-print media. Usually DTIs have a media-mix (the multimedia package) with sophisticated media forming either supplementary or complementary component. Use of sophisticated electronic media like teleconferencing, and interactive video increases the fixed costs. Within this framework, if the media-based courses are considered as products, large scale use of media would increase fixed cost; and if students are considered as products, large enrolment of students would reduce the unit and the marginal costs. Distance education then, becomes much cheaper than campus-based education, and therefore affordable.

15.4.3 Cost Functions

In sub-section 15.4.1, you have seen that fixed and variable costs together comprise the total cost. The fixed costs do not vary even when the volumes of activities vary, except when significant changes in the scale of activities occur. On the other hand, variable costs are directly related to the scale of activity, and they increase or decrease accordingly. The cost function in the conventional face-to-face education is highly

influenced by variable costs depending on the number of students. In distance education, the teacher is replaced by a range of media used for mediated communication, and this replacement changes the cost function in distance education. Significant amount of expenditure is incurred on items and processes before the students are admitted. These include preparation of self-instructional materials like print, audio, video, radio and television programmes, and printing or production of certain portions of these materials. Further, printing or production cost depends on the actual number of students enrolled for a particular programme/course.

The cost function in distance education in its simplest form is given as follows:

$$TC = F + VN$$

Where,
 TC = Total Cost
 F = Fixed cost
 V = Variable cost
 N = number of units of output (students/student hours)

In case of a linear cost function (with regard to total cost), average cost is calculated by simply dividing the fixed cost by output, and adding the variable cost to it. Thus, the average cost is:

$$AC = F/N + V$$

Where,
 AC = Average Cost
 F = Fixed cost
 N = Number of units of output
 V = Variable cost

In distance education, the number of students enrolled and the number of courses produced largely determine the total cost. Thus, the total cost may be re-written as:

$$TC = a + bx + cy$$

Where,
 TC = Total Cost
 a = fixed cost
 b = average cost per course
 c = average cost per student
 x = number of courses
 y = number of students

Average cost per student and per course can be obtained by dividing the total cost allocated to students and courses by the actual number of students and of courses respectively. (All the courses printed are not necessarily new ones). The courses may comprise both the ongoing courses which are simply maintained and the new courses which are developed for the first time. The cost function, in this case, gets extended further to include both the aspects:

$$TC = a + bC_n + cC_m + dS_n$$

Where,
 TC = total cost
 a = fixed cost
 b = coefficient of the number of new courses
 C_n = number of new courses
 c = coefficient of the number of maintained courses
 C_m = number of maintained courses
 d = coefficient of the number of new students
 S_n = number of students

The coefficients of new courses, maintained courses and students can be obtained by dividing the total costs allocated to these three heads by the number of new courses to be introduced in that year, the number of courses to be maintained in that year and the actual number of students respectively.

The cost function changes when the dependence of costs on output or volume of activity is taken into consideration. Four systems are important and common to any distance teaching institution, and almost all activities can be categorised into any of these systems. The four systems which constitute the total system of distance education include the following:

- production system (p)
- instructional system (i)
- evaluation system (e)
- administrative system (a)

If the total cost consists of total fixed and total variable costs, the equation would be:

$$TC = TF + TV$$

Then, the total fixed cost would be:

$$TF = TF_p + TF_i + TF_e + TF_a$$

Where, TF_p = Total fixed cost of the production system
 TF_i = Total fixed cost of the instructional system
 TF_e = Total fixed cost of the evaluation system
 TF_a = Total fixed cost of the administrative system

The total variable cost would be:

$$TV = TV_p + TV_i + TV_e + TV_a$$

Where, TV_p = Total variable cost of the production system
 TV_i = Total variable cost of the instructional system
 TV_e = Total variable cost of the evaluation system
 TV_a = Total variable cost of the administrative system

The total cost, therefore, is the summation of the total fixed and total variable costs for the four systems.

$$TC = (TF_p + TF_i + TF_e + TF_a) + (TV_p + TV_i + TV_e + TV_a)$$

The final calculation of the cost would depend upon the kind of production, instruction, including media-mix, evaluation and administration involved in any distance teaching institution.

15.5 ECONOMIES OF SCALE IN DISTANCE EDUCATION

Besides micro areas, some macro issues related to decision-making are also considered with regard to evaluation of a programme. “Economies of scale” is one of the most important indicators of the viability of distance education programmes.

Dutt (1988), in a study on the cost of conventional campus-based and correspondence education programmes in Indian universities, has pointed out that to be economically

viable a university has to have at least ten thousand correspondence education students. Most of the university correspondence courses institutes in India do not fulfill this criterion. Let's examine this in the context of IGNOU, and see to what extent the university can attain economies of scale.

The following assumptions are made for working out the optimum size of enrolment for which the University can reap the benefit of the economies of scale. The data are based on the study of Pillai and Naidu (1991).

- Whatever be the size of enrolment, the total fixed cost (both direct and indirect) would remain fixed.
- Certain proportion of semi-variable costs (viz. staff salary) has been incurred in the past, irrespective of the present decision of enrolling either large or small numbers of students. For instance, the University had incurred an expenditure of Rs.12508 thousand on the salary of the staff of Divisions like Admission Division, Evaluation Division, the then Communication Division, Regional Services Division, the then Material Distribution Division, etc., and on orientation programmes for the year 1989-90, with 45,859 weighted 32-credit equivalent students. Therefore, this expenditure may be considered as fixed up to an enrolment of 45,859 weighted full-time equivalent students; and further expenditure incurred on the additionally enrolled students would be considered as the marginal cost.

For an additional enrolment, beyond 45,859 weighted full-time equivalent students in the year 1989-90, the total variable cost of Rs.597.07 per student has to be added to the total cost.

The total cost, average cost and marginal cost for student enrolment ranging from 5,000 to 3,00,000 are given in Table 15.1.

Table 15.1: Total, average and marginal costs for different levels of student-enrolment

| Student enrolment | Total Cost (Rs. in '000s) | Average cost (Rs.) | Marginal Cost (Rs.) |
|-------------------|---------------------------|--------------------|---------------------|
| 5,000 | 5,95,22 | 11,904.47 | 597.07 |
| 10,000 | 6,25,08 | 6,250.77 | 597.07 |
| 20,000 | 6,84,78 | 3,423.92 | 597.07 |
| 30,000 | 7,44,49 | 2,481.64 | 597.07 |
| 40,000 | 8,04,20 | 2,010.50 | 597.07 |
| 46,000 | 8,40,02 | 1,826.14 | 597.07 |
| 50,000 | 8,75,20 | 1,750.40 | 869.82 |
| 60,000 | 9,62,18 | 1,603.64 | 869.82 |
| 70,000 | 10,49,16 | 1,498.81 | 869.82 |
| 80,000 | 11,36,15 | 1,420.18 | 869.82 |
| 90,000 | 12,23,13 | 1,359.03 | 869.82 |
| 1,00,000 | 13,10,11 | 1,310.11 | 869.82 |
| 2,00,000 | 21,79,93 | 1,089.97 | 869.82 |
| 3,00,000 | 30,49,75 | 1,016.58 | 869.82 |

You may derive the following conclusions from Table 15.1:

- The total cost rises with increase in student enrolment.
- The average cost declines with increase in student enrolment, and gets stabilised at the enrolment size of 70-80 thousand students.
- The marginal cost remains constant up to about the mid-point of the above mentioned size, i.e., up to about 40-50 thousand students (i.e. 45,859 students in our case for the year 1989-90), beyond which it increases and gets stabilised with an enrolment of 50,000 students.

The total cost increases at a decreasing rate due to decrease in the average cost and stabilization of the marginal cost. The marginal cost got stabilised at student enrolment of around 50,000. The University (i.e. IGNOU) can reap economies of scale up to an enrolment of 80,000 students. However, since marginal cost is still lower than the average cost, further economies of scale are possible up to an enrolment of even 3,00,000 students.

At this stage, it is imperative to take note of the cost functions of conventional as well as distance education as have been shown in Fig. 15.1 and Fig. 15.2.

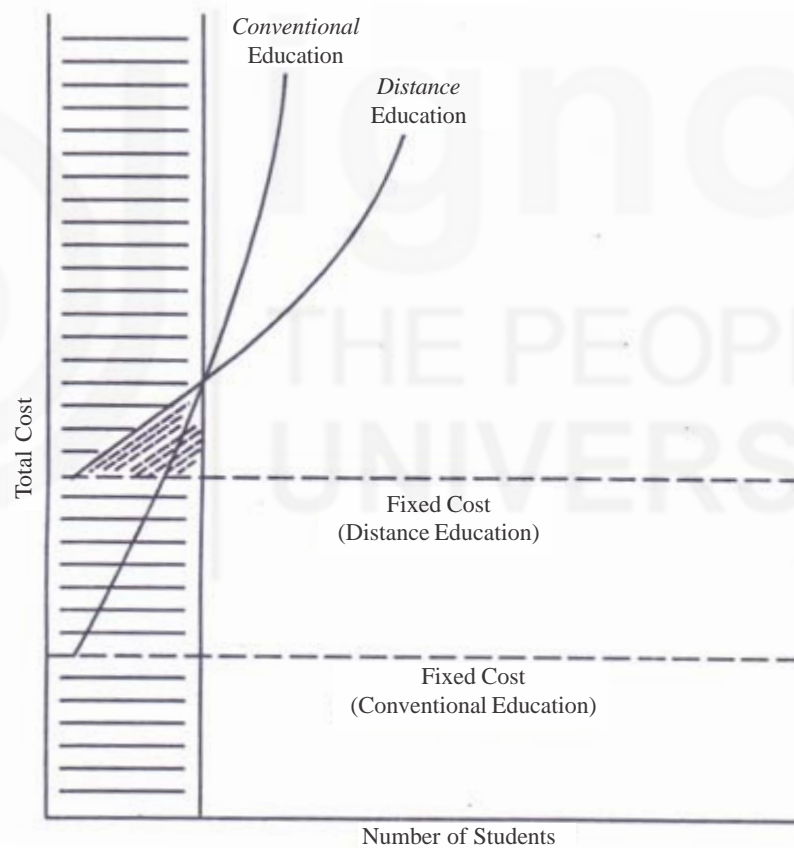


Fig. 15.1: Cost Functions (total cost) of the conventional and distance education systems

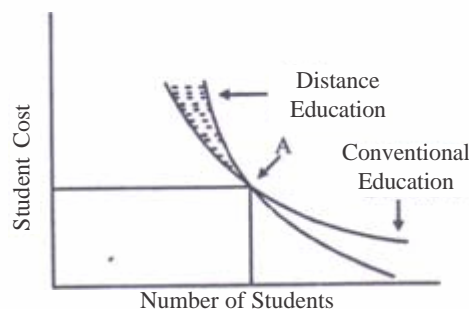


Fig. 15.2: Cost functions (student cost) of the conventional and distance education systems

You will find from Fig. 15.1 that though the fixed cost of distance education is higher than that of conventional education, the cost of distance education increases at a far more decreasing rate in comparison to that of conventional education. This further implies that the total cost of conventional education does not decrease much because of the limits to the increase in student enrolment in campus-based colleges and universities. On the other hand, there is an increase in the total cost of distance education at a progressively decreasing rate with increase in every student enrolment; and since the distance teaching institution (in this case, the IGNOU) can enrol an increasing number of students (which can certainly be higher than what a conventional college or university can), there is a decreasing trend in the increase of the total cost due to decrease in the average cost per student and the stabilisation of the marginal cost per student.

Now, let's look into the function of student cost in both the conventional and the distance education system (see Fig. 15.2).

Fig. 15.2 shows that at low student enrolment, the student cost in distance education is higher than that in the conventional education. But, this trend gets reversed at point A, where the student cost and student enrolment are the same for both the conventional and the distance education systems. Subsequently, with the increase in student enrolment in the case of distance education, the student cost (i.e., cost per student, or say the unit cost) keeps falling. You have seen in Table 15.1 that with the decrease in average student cost, the distance teaching institution could reap economies of scale up to an enrolment of even 300,000 students.

15.6 LET US SUM UP

In this Unit we have discussed: a) education (and distance education) as investment and consumption, and b) the contribution of education (and distance education) to human capital formation, and to the quality of the workforce. Distance education with its inherent flexibility and capacity of greater access can reach large number of students at a low cost, while maintaining high quality. Use of communication and information technologies facilitates this process. While evaluating distance education programmes, costing becomes an important consideration. In our discussion on how to calculate costs based on varieties of functional sub-systems of the DE system, we noted that cost of distance education is about one-fifth of that of the mainstream formal education, and DE has the potentiality of achieving economies of scale when it reaches a large mass of student enrolment, though there is a limit to the number. After it reaches certain level, marginal cost becomes higher.

Cost-effectiveness and cost-efficiency are two indicators which help us evaluate the programme effectiveness from the point of view of cost. The techniques of calculation of unit costs shall help us to have a comprehensive evaluation of an academic programme, since we shall be in a position to ascertain the effectiveness of the programme (and its various aspects) *in relation to the cost of the programme and its various aspects*. Thus, programme evaluation acquires more significance in our context when the economic aspects of distance education programmes are studied and evaluated with a comprehensive framework of evaluation.

15.7 ANSWERS TO ‘CHECK YOUR PROGRESS’ QUESTIONS

- 1) Education (especially that which provides skills for immediate use) is considered as investment in human beings; and it is a life-time investment. Like education, distance education (which is one of the modes of education) is also investment in human beings. Distance education provides greater access and equality of educational opportunity to acquire quality education at lower costs. It also caters to the continuing educational and professional development needs of adults.
- 2) For effective utilisation of physical capital, there is a need for quality human capital; and further, human capital is crucial to increasing productivity. Formation of human capital refers largely to qualitative dimensions, and individuals going through the processes of education and training acquire knowledge and skills, and develop attitudes which affect their productivity. Education itself is human capital; higher the education higher is the quality and capacity to generate and apply knowledge and skills to enhance productivity.

15.8 REFERENCES

Dutt, K. (1988). “Distance Education versus Traditional Higher Education: A Cost Comparison”, in B. N. Koul, et. al. (eds.), *Studies in Distance Education*. AIU and IGNOU, New Delhi.

Freeman, A. M. (2002). Environmental Policy Since Earth Day I: What Have We Gained? *Journal of Economic Perspectives*, Vol.16, No.1, pp.125-146.

Kruss, G., McGrath, S., Petersen, I., and Gastrow, M. (2015). Higher education and economic development: The importance of building technological capabilities. *International Journal of Educational Development*, Vol.43, July, pp.22-31, <https://www.elsevier.com/atlas/story/people/higher-education-is-key-to-economic-development> — Retrieved on 22-03-2017.

Lundvall, B. (2011). Notes on innovation systems and economic development, *Innovation and Development*, Vol.1, No.1, pp.25-38.

McMahon, W. W. (1999). *Education and Development: Measuring the Social Benefits*. New York: Oxford University Press.

Nelson, R. R., and Winter, S. G. (1982). *An Evolutionary Theory of Economic Change*, The Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Pillai, C. R., and Naidu, C. G. (1991). *Cost Analysis of Distance Education*, IGNOU, New Delhi.

15.9 UNIT END EXERCISES

You may write brief notes or full-length answers to the questions given here in your own interest. Such notes or answers might help you during your preparation for term-end examination.

Unit End Questions

- 1) Explain how (distance) education is both consumption and investment. (500 words).
- 2) How does education and ODE contribute to human capital formation and national development? (1000 words).
- 3) How do you distinguish cost-effectiveness and cost-efficiency? (250 words).
- 4) Discuss different types of costs and the factors affecting them. (1000 words).
- 5) Write a short note on cost functions in ODE. (500 words).
- 6) What do you understand by economies of scale in distance education? (500 words).



Questions for Critical Reflection

- 1) Explain the cost function with special reference to the organization in which you are working.

Activity



Identify different types of costs in respect of your school. Based on them try to draw the economies of scale for your organisation. (Do it on separate sheet(s) of paper).