UNIT 3: TECHNOLOGY AND INNOVATION

3.0 Overview

Technology and Innovation often go hand in hand. However, innovation can also refer to processes and service offerings. For innovations to happen, a number of individuals need to be involved, namely an innovation source, an innovation champion and a sponsor in support. In addition, a number of environmental conditions need to be satisfied.
In a University perspective, the tertiary institution is a source of innovative ideas provided it has R & D facilities, has procedures in place for IPR and can provide resources for start-ups, e.g. through University-Industry links.

### 3.1 LEARNING OBJECTIVES

By the end of this Unit, you should be able to do the following:

1. Relate innovation with technology in the context of people and required conditions.
2. Assess the requirements for an innovative climate in organisations.
3. Evaluate the role of Universities in spawning ideas and developing business opportunities.
4. Describe University-Industry collaboration in terms of the possible synergies.
5. Distinguish between the different types of business incubators based on purpose or sponsorship.
6. Learn the steps in analysing technology trends on the market with a view to identify opportunities.

### 3.2 INTRODUCTION

The opening case study describes an example of how an idea originating from a University Student’s research could later materialise into a major innovation, and subsequently a thriving business, using current technologies. A climate for innovation can be created in organisations by having the right people working in the right environmental conditions. Given the proper infrastructure for R & D, the legal (IPR) framework and institutional support, Universities can spawn ideas and business opportunities for Industry to take advantage of sharing mutual benefits.
Business incubators also play a major role in the initial and growth stages of start-ups by providing facilities, technological and managerial support as well as networking capabilities. Incubators thereby considerably reduce mortality rates of start-ups and enable innovations to survive the infancy stage of business development. Technological innovation results not only in developing new technology, but also in developing processes based on currently existing technologies.

3.3 OPENING CASE STUDY: uSHIP

Using Technology to Innovate

It’s easy to ship an envelope or a package, via the United States Postal Service, UPS, or FedEx. But what if you want to ship a larger item, like a piece of furniture, a car, or a boat? There are freight carriers available, but because they are designed to carry heavy and large loads, they are expensive.

Until now, uShip which was launched in 2003 in Austin, Texas, is an online marketplace for shipping. It uses a reverse auction system where users can list large or awkward items, like furniture or cars, and shippers can bid on the shipping job.

uShip was funded by Matt Chasen who, as a student, developed the idea as part of a school project while enrolled at the University of Texas. “uShip is a venue where people get together. We give customers the tools they need to find the right mover for their stuff. We give them feedback ratings.”

An individual logs onto the uShip Web site and lists a shipping job that needs to be completed. For example, say that a person bought an antique table while vacationing in Virginia, and wants to have it shipped home to Indiana. Shippers would then bid on the job. The shippers are all rated, similar to the way sellers are rated at eBay, and individuals can post positive and negative feedback about a shipper. The shippers that bid typically anticipate having an empty load of excess capacity on a route that passes near the pickup
and the delivery locations. The seller will normally accept the lowest bid, assuming that the shipper is satisfactorily rated. uShip makes money by collecting a 7.9 percent commission from the shipper who carries the load.

The company's feedback system holds drivers accountable for their service and rewards those that perform well. uShip's service is particularly popular among those selling large items on eBay and other auction sites.

(Source: www.uship.com)

Questions:

1. What technology(ies) is uShip using?

2. In what different ways is this service innovative?

3.4 INNOVATION AND TECHNOLOGY – PEOPLE AND CONDITIONS

Innovation is often explained in rather technical terms whereby technological developments result in tangible products or processes. Incidentally, there has been a focus on rational, analytical innovation models. One such model shows innovation as a development process, whereby an idea is translated into an application.
Translation of creative idea into a useful application

Analytical planning → Organising resources → Implementation → Commercial application

to identify: to obtain: to accomplish: to provide:
Product design Materials Organisation Value to customers
Market strategy Technology Product design Rewards for employees
Financial need Human resources Manufacturing Revenues for investors
Capital Services Satisfaction for founders

**Figure 1 – Elements in the Innovation Process**


The above is a general model of technological innovation. According to Modesto (1980), for a technological innovation to succeed, there are three important people who need to be involved and seven conditions to be satisfied.

**The three key people are:**

The Creative Source - the originator of the idea that led to the knowledge or new vision. The creative source is an individual or a group (brainstorming).

The Champion - the entrepreneur who materialises the idea, plans its application, organises resources, funds markets, thereby displaying leadership skills.

The Sponsor - normally the organisational managers who enable the champion’s endeavours by providing support, finance, network, and so on.

Therefore, “to foster a climate of innovation, managers must set expectations, support champions, recognise and reward innovation”. (Sorenson, 2004).
According to the same author, at 3M Company, supportive management takes place through the Genesis Program. Laboratory employees are encouraged to submit ideas for new products or technologies to a review panel of management and senior technical experts. Ideas judged to have the greatest technical soundness, future sales potential and strategic fit with business objectives receive corporate funding.

In “Managing Technological Innovation”, Brian Twiss, 1986 mentions the seven conditions required for successful technological innovation. These are related both to the relative successes of the three key people mentioned above and to the environment in which the innovation takes place.

1. An outstanding executive leader who encourages creativity and innovation.
2. An operational leader who translates knowledge into a commercial application.
3. A definite market need for the application to justify commitment of resources.
4. The innovation should provide value to society.
5. Good networking and collaboration among people and functions in the organisation towards achieving the objectives.
6. Ensuring resources (including technology) are available to enable the innovation to materialise.
7. Support of external stakeholders who have influence on the project, for example, government, investors, suppliers and so on.

**Activity 1**

Attempt to identify the three key roles and seven important conditions for innovation in the following Case Study.
Dr Dick Peterson’s dilemma at the Indiana University School of Medecine

In order to do his research, Peterson had developed a genetically biased diabetic rat model. Such rats are highly useful for medical researchers trying to cure or abate diabetes. At first, Peterson supplied his diabetic rats to interested colleagues at cost.

However, as interest and demand from other researchers grew, Peterson found that he needed to find a way to market his technology beyond what Indiana University could provide. With a team of five people, Peterson founded Genetic Models in 1991. The core product of Genetic Models consists of bred animal models, mainly rats and mice. The animals are bred with specific diseases, for example, obese male rats with diabetes. The animals are then sold to research laboratories that are testing disease cures.

Peterson and his team applied for financing from a bank. Peterson recalls, the bankers asked him what his business experience was. He answered truthfully: “None”. Then they asked about the demand for his laboratory rats and mice. Peterson’s answer was speculative, and this, like his complete lack of business experience was not encouraging to the bank. Next the bank asked about the company’s assets, and Peterson answered truthfully: his idea and scientific knowledge were all there was. Peterson was facing a major problem: what bank would finance someone with no business experience, no clear product demand, and no physical assets? He was turned down by bank after bank. Peterson was downright discouraged. Peterson would have given up on his dream of starting the firm, but fortunately, the federal governments’ Small Business Innovation Research (SBIR) program provided funding that enabled him to climb out of the Valley of Death to succeed and flourish.

(Source: Audretsch, 2007, The Entrepreneurial Society)
3.5 RESEARCH AND DEVELOPMENT (R & D) AND TECHNOLOGY TRANSFER – A UNIVERSITY PERSPECTIVE

As seen earlier under “Creativity”, innovative ideas involve some form of research and development in their generation and their subsequent application.

Although a number of famous entrepreneurs did start their early R & D in the family garage (Hewlett and Packard in the 30’s and Steve Jobs and Wozniak in the 70’s), today we think more in terms of a formal laboratory set-up in order to generate a steady flow of new ideas. In this case, we are presented with two possible situations. Firstly the entrepreneur himself/herself develops the idea and in this case will want to protect his/her intellectual property rights before anyone is tempted to steal the idea. Secondly the idea may belong to somebody else and the entrepreneur will wish to access/acquire it as cheaply as possible. In the second case, commercial exploitation of the idea refers to “technology transfer”. It should be pointed out, however that it is not only the technology that is transferred, but also the business idea.

Activity 2

Explain the above in the case of credit card technology.

Technology transfer raises a number of issues for the entrepreneur. These are:

- The role of the R & D laboratory in innovative idea generation.
- IPR (Intellectual Property Rights).
- The role of institutions in supporting the Opportunity.
3.5.1 The R & D Laboratory

Based on its crucial role in business idea generation, the R & D laboratory is a vital component of the support infrastructure, whether for a University or for Industry (or else a collaboration between the two).

Normally, R & D laboratories should exist to provide ideas for start-ups. However, research funding policies have often distinguished between pure and applied research. In some communities, funding mechanisms are related to academic performance which is measured by the number of published papers in referenced journals. A lot of academic rigour is present in the form of peer assessment and quite often rewards (for example, promotion and salary) are linked to such academic performance.

However, in this type of mechanism, commercial application is downplayed and researchers miss opportunities to commercially exploit or sell their ideas. Obviously a tension is created as to whether a University researcher should “publish and score” or “patent and develop”

Too many ideas thus remain locked in research laboratories or publications, failing to bring value to society.

Paul Romer (1986) showed in his growth model in economics that economic growth depends not only on labour and capital, but also on knowledge and ideas. Towards the end of the twentieth century, Universities such as MIT, Stanford and University of California…..became key engines of regional economic growth and employment. “New industries, based on new and potentially valuable research, sprang up around these Universities. The source of the new economic growth and jobs was quickly identified, and Universities were increasingly viewed as essential for economic reasons, not just the old traditional ones”. (Audretsch, 2007).

Activity 3

Make concrete proposals for University-Industry links in the context of technological
3.5.2 Intellectual Property Rights (IPR) and Patents

Technology transfer makes little sense without the protection of IPR. In both industry and Universities, it is crucial to operate a technology watch so as to capture and protect the knowledge that R & D generates. In practice, industry is more aggressive than academia in using IPR, as a result of competitive forces. In addition, industry can better afford to do so financially than Universities, given the cost of patenting, especially when world wide protection is concerned.

Since IPR can exist only in presence of a patent, universities without financial resources to support such patents can find IPR is rather an illusion. Furthermore, there is the often unresolved issue of whether the IPR belongs to the researcher or the University. In the case of private firms, the innovation belongs to the company since the employee is assigned to work on the R & D by and for the company. Since quite recently at UoM, researchers are made to sign a declaration to that effect before starting to work on a project.

The challenge for Universities is to motivate academics and student researchers to release the ideas potential. Universities could consider giving equal merit to published academic papers and to patents in assessments for pay and promotion. This requires prior clarification and codification of IPR issues and may subsequently require support for conventional exploitation of opportunities uncovered by R & D innovations.

**Activity 4**

Research the activities of the Business Pre-Incubator at UoM.
3.5.3 Role of Institutions in Supporting Innovation

The current approach in developed countries is to have technology parks attached to Universities and run in collaboration with Industry. Since the business of University (or its vocation) is not business itself, in order that commercial activities do not affect the core mission of the institution, Universities like Oxford University and Imperial College have separate companies through which commercialisation of IPR activities are licensed. Hence, Universities can sell IPR pertaining to technological and other innovation to the highest bidder in Industry. Otherwise Industry can finance research in University technology parks whereby the activities can bring in more income to the University and achieve the sought for University-Industry collaboration.

Although, the role of the University is not to indulge in commercial activities, its R & D function can give it the opportunity to enable start-up of new, innovative businesses.

**Activity 5**

Reflect upon the possibility of Universities holding a share of equity in new businesses in exchange of transfer of technology. What are the risks and benefits?

As mentioned in the case study earlier, other institutions including the governmental and private ones, can support technological development, especially for the benefit of small firms. Venture capitalists are private investors who, unlike banks, will fund high technology projects while taking huge risks, but expecting above average returns in the short to medium term (This will be discussed in more detail in the finance section).

Bridge *et al.* (2003) report that in the U.K, a University Challenge Fund was set up in 2001 to encourage the transfer of science, engineering and technology from the Universities to commercial applications. Government provided $65 million as venture capital funds to enable Universities to develop their business proposals and start up companies.
In Mauritius, organisations like the Mauritius Research Council support applied research but Industry has a major role in materialising R & D applications.

### 3.6 BUSINESS INCUBATORS

According to Scarborough *et al.* (2006), business incubators have been around in the U.S for four decades and have spawned more than 20,000 successful businesses. Business incubators vary to some degree as to the types of businesses they attempt to attract, but most incubator residents are engaged in light manufacturing, service businesses and technology or research-related fields.

The business incubator is an increasingly popular form of business assistance. It is a dedicated space provided to help businesses get established and become profitable. Typically it consists of one or more buildings which house offices and workspaces/labs for new businesses. The incubator is overseen by a centre manager who has experience in working with new and entrepreneurial ventures.

The incubator combines low cost, flexible rental space with a multitude of support services for small business residents. The rent is often below market rates and services may include financing assistance, shared use of equipment such as copiers and fax machines, shared conference room and management consulting facilities. They are commonly sponsored by government agencies, universities or private developers.

**Activity 6**

The National Computer Board operates an ICT incubator. Search the Website of NCB with a view to understand the roles and functions of the NCB Incubator.
Apart from the NCB, in Mauritius, the SEHDA and the National Women Entrepreneur Council run incubators.

“Incubators are not designed for long term leases but, instead, are meant to help start ups in the early, difficult years. Most incubators require that tenants ‘graduate’, meaning that the company can be a tenant for only three to five years. The company is then expected to join the ‘real world’ and pay market rent in regular commercial space”. (Lambing & Kuehl, 2007).

Generally, incubators are organisations designed to assist and accelerate the growth of small businesses providing concentrated critical resources during the key development period.

### 3.6.1 Services Offered by an Incubator

Typical services offered by an incubator include:

- **Access to conveniently located, reasonably priced tenancies.** Lease space and rates are flexible, but duration is normally limited, unlike commercially run shopping spaces.

- **Administrative services.** Most incubators provide shared equipment, telephone systems, internet facilities, administrative staff (for example, reception and cleaning)

- **Business advisory services.** The manager of the centre will usually help tenants solve specific business problems, for example, marketing strategies or to identify training needs. Regular reviews of the business give insights on growth prospects and change in business orientation.

- **Expert advice.** The incubator managers can seek expert advice from University professors or business leaders, bankers and so on. on major strategic business issues.

- **Business support.** Incubators form a network of managers and business people who can provide mutual support, sharing ideas and knowledge and forging business collaborations.
3.6.2 Types of Incubators

Incubators can be classified based on sponsorship or purpose (Kaplan, 2004).

- **Publicly sponsored incubators** (67% of U.S incubators) are organised within government or parastatal bodies and pursue job creation objectives along with business development and economic growth.

- **University related** (24% of U.S incubators). Most University incubators are focused on science and technology. They develop businesses based on research started by Universities. Major objectives include technology commercialisation with a return on investment.

- **Private for profit incubators** (9% of U.S incubators). These incubators are run by private investors who expect a return on investment. Harvard Business School conducted a survey of for profit incubators in 1999 during the peak of the Internet Market and found that most of them were investor led, focused on the internet and were designed to accelerate the speed and size of the start up.

Some incubators may also be classified by type based on specialisation. Incubators can be industry specific, for example, for ICT, Arts related businesses and so on. San Francisco-based women’s Technology Cluster is a high tech incubator for female entrepreneurs. The Cluster assists high tech women entrepreneurs in hosting weekly seminars on business skills and offers services in recruitment, finances, public relations, sales and web design.

3.6.3 Incubator Access

Despite the increasing number of incubators being developed, the demand for incubator space is generally high in developing countries. Incubators are therefore selective about the tenants they admit. They have rigorous application procedures and selection is based on business plan presentation. Business incubators, for example, will not admit “limited family businesses that do not plan to create jobs, develop new technologies or strengthen the local economy”. (Lambing & Kuehl, 2007). Private incubators sometimes want an equity stake in the start ups they nurture.
Depending on the entrepreneur’s willingness to share equity, for profit incubators can ask up to 45% equity, may wish to take a more active role and stay in longer than venture capitalists.

Acceptance by a reputed incubator enhances the credibility of a start-up since it represents same sort of “Good Housekeeping” seal of approval, why most incubators are highly selective about who they admit.

Case Study

When the biotech company that he ran from a spare bedroom in his home acquired the exclusive license to a breakthrough system that delivers medicine straight to the heart, James Grabek knew it was time to take his company, Comedicus, Inc. to the next level. Fearful of losing control of his business, Grabek ultimately turned to Genesis Business Centers, a business incubator in Minneapolis, Minnesota. Harlon T. Jacobs, president of Genesis, offered Grabek access to $50,000 in financing, free office space and management assistance in exchange for just 5 percent of the company’s stock.

Grabek decided to nurture his business in the incubator and quickly accepted the offer. Within 15 months, Genesis had helped Comedicus raise $1 million in a private placement and have $4 million in licensing agreements with major pharmaceutical companies. “It was a turning point that catapulted us into the corporate world”, Grabek says of his decision to move into the incubator.

(Source: IANNOU Lori: “Start-Up with a Catch”, Fortune, July 20, 2008)
Activity 7

Refer to Case Study above. Try to establish how access to the incubator made a turnaround in Grabek’s business

3.7 TECHNOLOGY TRENDS AND APPLICATIONS

In order to launch innovative ventures, entrepreneurs ought to scan technology trends in the market. According to Kaplan (2004), the steps to be followed are:

- Identify systems and technology for new ideas, e.g. predicting which technology will capture the market and processing ideas into new opportunities.

- Investigate the environment for technological and market conditions. An environmental analysis evaluates the changing environment to discover trends in business and assess their impact e.g. is there a need for the technology?

- Plan the technology project. A project team identifies the business value of the technology and the system is built based on architecture design, interface design etc. to ascertain functionality.

- Conduct a feasibility analysis. Once the need for the technology and its basic functionality are established, technical and business feasibility are established by measuring available resources and matching the risks.

- Perform market forecasts and establish benchmarks. Forecasting measures growth in revenue, market share and profitability while benchmarking refers to the company analysing how other companies (competitors) perform the same processes or service.

- Benchmarking is done with a view to reengineer and improve technologies so as match or exceed current best practice.
3.8 EXAMPLES OF HIGH OPPORTUNITY PRODUCT CATEGORIES RELATED TO CURRENT TECHNOLOGICAL INNOVATIONS

- Software applications
  Enterprise Portal Software brings together information from various stakeholders to create a customised electronic system that can be used by business partners, customers and employees. It allows access to data and information for strategic decision making e.g. in sales and marketing.

- Wireless applications
  Higher speed connectivity brings business opportunities for new cell phone devices and a host of innovative new applications in mobile commerce.

Activity 8

It is estimated that at this date, only 10% of mobile phones in use in Mauritius have WI-FI capability and the majority of users are relatively young. Does this present an opportunity or a threat to mobile commerce?

- Business applications
  Customer Relationship Management (CRM) software enables businesses to acquire and retain customers in the marketing, sales and service functions. The potential of CRM is still untapped in most sectors in Mauritius.

- Security and Disaster Recovery
  Security may take the form of software that verifies the identity of an individual before allowing access to applications and other resources. This is increasingly making use of Biometric systems e.g. fingerprint, voice, face or eye iris. One telecoms company in Mauritius invested in its own disaster recovery system and
even tried to lease the facilities to other organisations, probably in an attempt to recoup the initial investment.

## 3.9 SUMMARY

In order to continue riding, the industry life cycle before maturity and decline, firms need to innovate continually. It was found that well planned University-Industry collaboration either through Science and Technology Parks or through Business Incubators can perpetuate the wheel of Innovation. Innovation is the key to business survival and growth and by extension for a country’s economic growth.

## 3.10 REFERENCES