

## Exam

### **IOE011: Economic Analysis 3: Innovation Economics**

(Ekonomisk analys 3: Innovationsekonomisk analys)

**Date and time: Monday, October 26, 2015, 08.30–12.30**

**Place: V building**

**Examiner: Marcus Holgersson**

Questions will be answered by Marcus Holgersson who will visit the exam room at (roughly) 10.00 and 11.30. He can also be reached by telephone (0739-431121).

The graded exams can be reviewed on November 24 at 12.00-13.00 and on November 30 at 12.00-13.00 in the Innovation corridor (Vasa house 2, 3<sup>rd</sup> floor). The request for correction shall be in writing and must be delivered to the course administrator no later than 2 weeks after the second opportunity for reviewing. After this the possibility for reviewing and correction ends. Only obvious errors, such as errors in the summing of the result will be corrected later. When the student chooses to bring the graded exam home all possibilities for correction of the result ends.

- The exam can give max. 50 points. Note that some questions give more points than others.
- **Give brief and concise answers, in Swedish or English.**
- **IMPORTANT!**
  - Write (*legibly*) your exam code on each answer page and number all pages.
  - Max. one answer per page. Please, do not write on the back.
  - This is vital as the separate questions are split up for correction and then sorted back again into the exam cover before breaking the anonymity seal.
- Ordinary language dictionary (**without notes**) and Chalmers-approved calculator are allowed.

- Q1 (5p)      What is meant by the following concepts? Explain very briefly.
- Innovation
  - Dynamic economies of scale
  - Veblen good
  - Debt threshold
  - Patent hold-out (as described by Claudia Tapia)
- Q2 (4p)      What is meant by the following concepts and what is the distinction/relation between the concepts in each pair? Explain very briefly.
- Economic success / commercial success
  - Supply side / demand side R&D and innovation policy
- Q3 (9p)      Are the following statements **true** or **false**? (The latter alternative – false – should also be used if the statement makes no sense.) No motivation is needed. Indicate for each statement the most correct answer, true or false. A correct answer gives +1p, an incorrect answer gives -1p, and no answer at all gives 0p. The total number of points given from this question will however not be lower than 0p.
- Coase theorem applies to a factory with a linear cost curve upstream a water plant.
  - Coase theorem states that property rights do not matter for internalizing a negative production externality as with a polluting factory upstream a water plant.
  - An innovation procurement contract for an R&D project typically guarantees commercial success in case of technical success.
  - In a 2x2 game it is possible to have 3 Nash equilibria.
  - A sailing effect relates to the improvement of an old product generation when a new generation enters the market.
  - An investment project with a negative cash flow (-10) in year 0 gives positive cash flows in year 1 (+3), year 2 (+7), and year 3 (+5) (no other cash flows). If the discount rate is 10%, the net present value of the project is positive.
  - If two products are complements their cross-elasticity of demand is positive.
  - According to the model by Utterback and Abernathy the rate of product innovation is typically increasing over time, while the rate of process innovation is decreasing, after the introduction of a new product.
  - In the linear case, with linear demand and cost functions, both total revenue and quantity always increase when a patent expires.

Q4 (17p) Assume that you are the CEO of a firm that is about to launch a new product innovation. The estimated inverse demand function for the product is  $p = -0.3q + 12000$ . The constant marginal cost  $MC_0$  for producing is 7000/unit. Assume unit demand, no current competition, no fixed costs, and a one-period case. [Motivate all your answers with clear calculations/arguments.]

- a) (2p) At which price do you maximize profits?
- b) (1p) What would the profit be at this price?
- c) (1p) Show your maximal profit graphically with help of the inverse demand curve. Mark all different relevant areas in to your figure.
- d) (2p) What is the general formal definition of the price elasticity of demand? What is the elasticity in the point where profits are maximized? Explain with words what this specific elasticity means.
- e) (2p) Now assume that you have the option to use dynamic pricing strategies. Explain two such strategies and how you could gain from each of them.
- f) (2p) Which of the two strategies above would you choose if there are constant returns to adoption and no switching costs for customers? Elaborate on your reasons why based on the information given (here assuming a possibility for new competitors).
- g) (2p) Assume that you are considering an investment in process improvements  $R$ , and you estimate an invention possibility function  $MC_1 = 7000 - 0.0001R$ . What is the smallest investment in R&D you can make to create a major process innovation? Please also define what a major process innovation is, as compared to a minor process innovation and as described in the course literature.
- h) (1p) Do you consider the above investment in process improvements economically successful? Why (not)?
- i) (4p) Assume that you choose NOT to make the investment in process improvements, and instead consider doing an investment  $R$  in a minor product innovation, giving an increase in demand and a new inverse demand function  $p = -0.3q + 12000 + 0.5\sqrt{R}$ . What is your optimal investment in the minor product innovation and what would the value of such an investment be? (Assume that you only market the improved product.)

Q5 (15p) You are the project manager of an online gaming service innovation project in a large profitable firm. You are using the customer development process in your project.

- a) (3p) Briefly describe the customer development process, how it relates to business models (without describing the business model canvas in detail), and how your project can benefit from using the process.
- b) (2p) In the customer development process, you come across a potential typical customer who makes the following statement:

“I like the service that you show me, but I would only be willing to pay \$1/month for it, unless my two best friends would also join. But if they join, I would be willing to pay \$2/month. By the way, I need to ask my mom for permission before buying it.” – Adam, 10 years

What does this information tell you about the dissociation of purchasing roles and the externalities related to this gaming service?

- c) (2p) In the R&D process you are considering whether to patent the underlying invention early or late. The time to market is relatively short while the gaming service’s lifetime on the market is relatively long. What is the (one) most important reason to patent early and what is the (one) most important reason to patent late in this specific case, and what is your recommendation? Motivate briefly.
- d) (5p) Unfortunately your patent application was not successful, and just as you are about to spend a year and \$5M on developing some final improvements of your gaming service you realize that a competing and non-compatible service (a substitute) has been launched on the market. Thus, the competitor will have a market lead time of one year. You are now considering to speed things up, spend an extra \$5M on consultants to enable an earlier market launch within 6 months. At that time, you could offer your service with the same initial customer value as if you would launch it in one year, but due to limitations in the service the earlier market launch would lead to a slower increase in return for each new adopter than if you would launch it in one year. Due to your competitor’s market lead time, you realize that you initially will have to price your service below your constant marginal cost (even if you manage to launch it in 6 months). *If you want your gaming service to be locked in, how should you evaluate the option of launching early or late based on the important parameters for this case?* Assume that you want your initial loss, including the development costs, to be as small as possible. Also assume 0% discount rate, 0% tax rate, constant marginal costs, and that your competitor has a constant, positive, and known price on its service, while you are free to use dynamic pricing. Both services are related to linearly increasing returns to adoption (but with different rates).
- e) (1p) Your CEO calls you into her office and informs you that the project will be cancelled because of your “need to invest the additional \$5-10M, and even though your yearly operating profits will likely be \$2M for several years you will never be able to recover the original investment of \$30M already spent on R&D”. Do you agree with the cancellation of the project? If yes, motivate with one sentence; if no, try to convince your CEO with one sentence.
- f) (2p) Now assume that your service would be the only service of this type on the market (with total number of customers N). What kind of diffusion model would most likely be best to model the buyer diffusion related to your service? Name it, describe it in one sentence, graph it, and provide a formal specification of it.