Minerals engineering education at LTU

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I normally give you a report every year on “our” education at LTU. So even this year.

Note, that my newest affiliation is the Department of Civil, Environmental and Natural Resources Engineering.
New department structure

• Beginning 1 January 2011 the LTU has shrunk the number of departments
• Civil, Environmental and Natural Resources Engineering
  – Chemical Engineering and Geosciences
  – Civil, Mining and Environmental Engineering

LTU has shrunk the number of departments from 13 to 6. The idea seems to be that this is the maximum of underlings any chief may be able to handle.

It implies that all talk about “flat” organisations is forgotten, and that we are back to the “pyramids”. Well, this is the organisation fashion for now and we will have to live with it, and continue to do what is the best for education and research.

In practice, it means that we have a new department – with a long name, It consists of our old Department of Chemical Engineering and Geosciences, and the former Department of Civil, Mining and Environmental Engineering.

A good thing with this structure is that all mining, mineral and metallurgical engineering now is in one department.

A not so good thing is that it will be a department with close to 300 people, and that we will have only 6 divisions.
Education for Natural Resources at LTU – 1

• Arena – Resources of the Earth
• Three M. Eng. Programmes
  – Civil Engineering
  – Natural Resources Engineering
  – Sustainable Process Engineering

You may recall from my presentation last year, that our old Chemical Engineering programme was cancelled and that we had no students entering in the Autumn of 2008.

But we did, together with the Northern process industries, a very rapid turn-around and produced plans for a new engineering programme, Sustainable Process Engineering (Industriell miljö- och processteknik (IMP)) that was accepted by the Board of the Faculty in late Autumn 2008.

So, now within the new department we have more programs related to Natural Resources. We have 3 Master of Engineering programmes, and an Arena with more of free studies. All are in principle 5-year programmes.

And, then we have programmes where we are cooperating with other universities. The foremost of them is the Nordic Mining School, which is a joint Master programme between LTU and Oulu University in Finland. There was a presentation about at 2009 year’s conference. We have had our first student exchange in the Autumn of 2010.
Education for Natural Resources at LTU – 2

• International Master programmes
  – Exploration and Environmental Geosciences
  – Civil Engineering, with specialization in Mining and Geotechnical Engineering

• Shorter courses/programmes ≤ 2 years
  – Gemstone Technology

An then we have shorter programmes with a duration of 2 years.

The international master programmes are more or less identical to the last two years of the corresponding engineering programmes. Omitted from the list here are the two master programmes corresponding to the last years of the SuPEr programme. This since we do not yet have any of our own students in year 4 and 5.

The short programme on Gemstone Technology is our most popular programme. It admits students on a bi-annual basis, and is normally over sought 2 – 3 times. It is located at Lannavaara, only 300 km due north of Luleå ---
**September 2010**

<table>
<thead>
<tr>
<th>Program</th>
<th>Registered</th>
<th>Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil M Eng</td>
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<td>40</td>
</tr>
<tr>
<td>NatRes M Eng</td>
<td>7</td>
<td>25</td>
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<tr>
<td>SuPEr M Eng</td>
<td>21</td>
<td>25</td>
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<tr>
<td>NatRes B Sc</td>
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<td>10</td>
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<tr>
<td>Arena Res Earth</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>M Sc Geosciences</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>M Sc Mining/Geotech Eng</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Here I list the number of fresher registrants for each programme for the current academic year.

It is obvious that with the new department we are drastically increasing our student pool. Also, that our own “old” programmes do have problem in attracting students.
Here is a diagram for the students that might end up in the Minerals and Metallurgical Engineering option. It is mostly based on the number of fresher students registered for the Autumn semester. Some years it might have been the number of applicants.

Note, the small number of students entering in 2003 that will have a large influence 5 years later.
You saw this scheme last year too.

What is important is that our second batch of “SuPErs” are now half way through their first year. So far we have lost only 2 students that changed to Natural Resources Engineering. And that’s a loss within the “family”.
Contact day

• The supporting companies meet the first year students in December
  – To register interest for mentorship
  – Explain about internships

To deepen the contact with the supporting process industries (Boliden, LKAB, SSAB on the MinMet side – Billerud, SCA, SmurfitKappa on the “other side”) we arrange a contact day for the first year students every year.
SuPEr – Year 2

|--------------------------|-----------------|---------------------|-----------------------|

The second year is about wider studies in mathematics and chemistry, but we also introduce the first engineering course and an economics course.

Mechanical Process Technology is mostly about mineral processing unit operations, and by that gives the students their first hands-on experience with comminution and separation technologies.

The SuPErs entering in 2009 is now in the third quarter, although the numbers have shrunk. More about that later.
In the third year the students will continue with more advanced engineering courses. It is given for the first time next academic year, that is, starting Autumn 2011.

The new course Environmental Analysis will try to teach three basic concepts from an industry point of view:

- LCA, Life Cycle Analysis
- GIS, Graphical Information Systems
- EIA, Environmental Impact Assessments

These code words are often hitting the industry, which seldom do grasp their implications, and is more or less in the hands of consultants.

The idea is here, to give the students some knowledge about these methods, so they may understand their weaknesses and limitations. Also, that they will understand the demands the concepts put on the industry, and what information the industry needs to supply to the society.
SuPEr – Year 4-5

• Trainee semester
• One year – two options
  – Sustainable mineral and metal winning
  – Renewable products and fuels
• Thesis semester

The forth and fifth years are almost identical to the present options in the Chemical Engineering programme.
Statistics – 2009 freshers – variables

• Quantities
  – ECTS Autumn sem.
  – 1st Chemistry test
  – 2nd Chemistry test
  – ECTS after 1 year

• Indicators
  – High school programme
    • Natural sciences
    • Technical
    • Free school/program
    • Special
  – Math E in high school?
  – Staying after 1 year?
  – In 2nd year spring sem.?

We have had a fairly huge drop-off from SuPER, only 16 remaining in second year of originally 29 freshers.

We have tried to analyse that by looking at the production of ECTS-credits as a function of some indicator variables. The list gives you an idea of what we are looking for – from the raw data we suspected some coupling to the amount of math in high school, and the type of high school programme.
I have analysed the data with multivariate statistics and show here the PLS regression for the first two principle components. Note, that only direction one is significant, but the second was added for clarity.

The four quantity variables are put in an Y block, and are close together. The X variables that show the best correlation with the Y block are: Math E and high school programme Natural Sciences. This might not be surprising as such, but that the correlation is so strong.

Another tendency is that the total ECTS production after the first year is coupled to the students staying in the programme. This implies that although a student may have problem in the first semester, some can catch up after the retake periods.
Statistics – 2010 freshers – variables

• Quantities
  – ECTS Autumn sem.
  – 1st Chemistry test

• Indicators
  – High school programme
    • Natural sciences
    • Technical
    • Free school/program
    • Special

If we are looking at the results for the current freshers we do not have much information. We have some quantity data, but one indicator is missing – Math E. This is due to that, from this academic year, Math E is a mandatory pre-requisite for all Engineering students in Sweden.

So, there is only one indicator left – the high school programme.
The resulting PLS model is of course very weak, no significant principle components.

The figure does show, however, that there still is a strong correlation between credit production and high school programme Natural Sciences.
What is next?

We know how many students we have in the system, and can therefore make some educated guesses for the near future.

It looks like we in 2011 to 2012 will have approximately 5 students a year leaving LTU with an option in Mineral Processing and Metallurgy. The numbers for 2011 are of course more sure. Only one student is, however, doing the thesis with a mining company.

Note, that in 2007-2008 we had only one student graduating pro year. This was the effect of the low enrolment numbers in 2003 that I mentioned earlier.

In 2013, we forecast no new engineers. An effect of the 2008 closure of the Chem. Eng. programme.
So, now when we see the end of the programme, where have all the students landed?

It turns out that they have stayed on the right side, that is, MinMet.

But what is important – the option has got a SuPEr life in the future!
We are up and running!

To summarise it!