Open innovation challenges/
new IP management approach

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What drives the trend from internal R&D to open innovation?

Globalization and intense innovation competition: Catching up and growing importance of emerging economies

Necessity of innovation speed in order to justify R&D investments

Importance of scientific knowledge for industrial innovation: particularly for bio-pharmaceuticals

Institutional changes in science sector: PRO’s and national university reforms (US 1980’s, Europe and Japan 1990’s, Norway early 2000’s).
Open innovation in the university arena

“Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.”

Chesbrough, Vanhaverbeke, West

“A broad base of research forms the foundation for ideas that are useful to society and have potential for commercialization.

We must strengthen interdisciplinary research on innovation processes, and encourage innovation among students and staff.

Effective innovation requires closer, stronger and more professionalized collaboration with the private and public sectors.”

Johan Hustad
vice chancellor, NTNU
NTNU and Open innovation

• 10,000 researchers
• 40,000 students
• National responsibility for education and research within technology and science.
Item 3 - Innovation:

- We will professionalize and develop external relationships internationally, nationally and regionally.
- We will increase our research commitment to processes related to innovation and entrepreneurship.
- Innovation activities at NTNU will emphasize interdisciplinarity and collaboration with business and society.
- We will offer infrastructure and professional support functions for staff, students and spin-off companies.
NTNU and industry collaboration

• In the “new” knowledge economy open and collaborative innovation is key.
• Need to unite this with the three main tasks of the university:
  • Research,
  • Teaching
  • the “third mission” of knowledge transfer in a wide sense
• 3rd mission: one of the important dimensions of successful innovation – beyond sufficient direct investment in academic or private R&D – is the extent of collaboration between universities and enterprises through technology transfer (e.g., R&D or industrial partnerships, licenses, spin-offs etc).
• Expansion of fields of research like ICT, biotechnology and nanotechnology provide arenas for increased, closer and new forms of university-industry relations.

Contradictive elements:

• university
  • required to devise open innovation strategies for publicly funded research focused on publications and dissemination
• industry:
  • When performing collaborative R&D - investments in research which often requires secrecy in a competitive market
**Intellectual Asset Management – (new) approach to IP management**

1. A systemic approach for collaboration is needed, beyond agreement regulations and solving IP-related problems.

2. More open and collaborative innovation is possible in university-industry contexts if the parties play a more proactive and opportunity-driven role.

**Objectives:**
- to increase the absolute amount of university-enterprise collaborations and to speed up innovations
- to improve – in a sustainable manner – the capacity of industry to manage innovation in an open and collaborative way with university partners.

We collectively need industries (and indirectly universities) that are able to absorb and create IP in order to generate the maximum commercial outputs from all sources of IP, and especially from local universities.
Intellectual Asset Management - benefits

**University benefits**
- Value creation
- Long-term relationships
- Industry verification
- Dissemination
- Access new technologies
- Expertise – complementarity
- Funding/revenue
- Knowledge Transfer
- Bringing products faster to the market
- …

**Industry benefits**
- Early IP access
- Low cost R&D
- More systematically structured technology
- More systematically structured Intellectual property management
- More systematically structured collaborations
- Predictable intellectual property access
MultiGuide – an IAM case study on open innovation from NTNU Technology Transfer AS and CIP PS

A new approach to IP management
• 1000's of Norwegians suffer from headaches related indications.

• Cluster headache, also called suicide headache, is the worst kind because of the relentless pain it provides.

• By inhibiting a nerve structure (ganglion), SPG, in the head with a neurotoxin, eg. Botox, the pain can be reduced or at best disappear.

• By sticking a pistol similar tool through the nose and behind the eye, surgeons paralyzes SPG with Botox. With the advent of MRI and a special navigation tool the surgeon knows exactly where nerve knot is. The surgery takes 30min.

Large no. of patients

<table>
<thead>
<tr>
<th>CHRONIC CLUSTER HEADACHE</th>
<th>EPISODIC CLUSTER HEADACHE</th>
<th>FREQUENT EPISODIC MIGRAINE</th>
<th>CHRONIC MIGRAINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 800</td>
<td>508 000</td>
<td>14 224 000</td>
<td>5 080 000</td>
</tr>
<tr>
<td>People suffer from chronic cluster headache in Europe</td>
<td>People suffer from periodic cluster headache in Europe</td>
<td>People suffer from episodic migraine in Europe</td>
<td>People suffer from chronic migraine in Europe</td>
</tr>
</tbody>
</table>

Approx. 20 mill. in EU
Navigation based solution

Safer
Faster
Better

Inventors
Daniel Bratbak, MD
Prof. Ståle Nordgård, MD
Erling Tronvik, MD
From possibly one patent application...
...to 47 different valuable assets

By defining and analyzing knowledge as objects, we’re able to use a more structured and systematic approach to manage and use the knowledge.
Intellectual Asset Management

Identify ➔ Characterize ➔ Communicate
Why Intellectual Asset Management?

Manage diffuse knowledge which is hard to define... ...make them into more specific assets that are easier to communicate, control and manage.

<table>
<thead>
<tr>
<th>Data</th>
<th>Databases</th>
<th>Instructions</th>
<th>Data correlations</th>
<th>Theoretical frameworks</th>
<th>Technical solutions</th>
<th>Software/algorithms</th>
</tr>
</thead>
</table>
IAM turns know-how into manageable intellectual assets

Examples of output

- Databases: 1
- Software: 2
- Instructions: 9
- Data correlations: 5

47 valuable assets

Examples of output

What is already patented?

What is not patented or in other ways protected?
What are we using these results for?

"An IAM-based approach helped us in prioritizing among several possible value chain positions, designing a suitable business model and defining a strategy for managing the IP portfolio."

"These assets has not yet been protected by patent applications, must be analysed together with the overall business strategy"

"Now it is more easy to have a professional and predictable relationship"

"Do you have all agreements in place, with previous inventors and staff?"

"What is really different between your technology and competing technology?"
Methodology and project structure

1. Project introduction and report overview
2. Intellectual asset portfolio overview
   Technology asset portfolio overview
   IPR asset portfolio overview
3. External stakeholder network overview
4. Utilization option analysis
5. Recommended next steps
A. Appendices
# Technology asset portfolio overview

## Intellectual asset portfolio composition

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>3</td>
</tr>
<tr>
<td>Database</td>
<td>1</td>
</tr>
<tr>
<td>Data correlation</td>
<td>5</td>
</tr>
<tr>
<td>Theoretical framework</td>
<td>0</td>
</tr>
<tr>
<td>Technical solution</td>
<td>27</td>
</tr>
<tr>
<td>Software</td>
<td>2</td>
</tr>
<tr>
<td>Instructions</td>
<td>9</td>
</tr>
<tr>
<td>Visualizations and simulation</td>
<td></td>
</tr>
</tbody>
</table>

## Comments

- There are a total of 47 different assets in MultiGuide portfolio.
- The main category of defined assets are technical solutions related to surgical methods, image processing and interventions.
- The MultiGuide portfolio also consists of a significant number of procedures and protocols to perform surgery and pre-processing images.
- Other, less valuable assets include clinical efficacy and safety of medical image data as well as software for a surgical navigation system.
Technology tree: Technology asset allocation

Image-guided surgical intervention system

Intervention procedure
- Intervention diagnostics
- Intervention modality
- Intervention protocol
- Intervention response evaluation

Intervention instrumentation
- Working instrument
- Instrument holder
- Instrument handle
- Instrument guide
- Disposables
- Accessories

Intervention navigation and localization
- Image acquisition
- Image transmission
- Image processing
- Image visualization

Legend:
- No of related Multiguide/NTNU valuable assets

NTNU Technology Transfer as
Using the technology tree as a basis distinct intellectual assets are defined from the cloud of know-how.

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Description</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA-01</td>
<td>A method surgical intervention</td>
<td>A method for surgical intervention into the brain by the steps of i) xxx, ii) xxx and iii) xxx.</td>
<td>Technical solution</td>
</tr>
<tr>
<td>TA-02</td>
<td>A database of surgical navigation images</td>
<td>A database of surgical navigation images each of which provide xxx</td>
<td>Database</td>
</tr>
</tbody>
</table>

Example MultiGuide IAs for illustrative purposes. A portfolio can contain hundreds of intellectual assets.
The analysis requires further assessments and tagging of relevant technology assets.

### Assessments (examples)
- **Value**
  - Value for commercial offering
  - Value for collaboration output
- **Control**
  - Secrecy-based control
  - IPR-based control
  - Contractual control

### Tags (examples)
- **Creator**
  - Who created the intellectual asset?
- **Owner**
  - Who controls the intellectual asset?
- **IPRs**
  - What IPRs are associated with it?
- **Tech area**
  - Which technical area does it relate to?
- ** Contracts**
  - What agreements apply, if any?

### Asset characteristics
- Development level
- Difficulty of imitation
- etc

### Value parameters
- Value for commercial offering
- Uniqueness
- etc

### Control parameters
- IPR based control
- Secrecy based control
- etc

The assessments are divided into 3 areas:

Based on CIP Professional Services methodology
Characteristics of the IP portfolio

Assets that are highly valuable

- **TA-01**: An adaptable intervention device
- **TA-06**: A collection of working instrument and proximal pieces
- **TA-08**: A collection of end pieces
- **TA-11**: An image-guided device with a slideable track
- **TA-12**: An device having a rigid lumen end piece made from titanium
- **TA-13**: An end piece design framework for altering the diameters
- **TA-17**: An image-guided intervention device having a display cradle
- **TA-23**: A protocol for MRI imaging that enables localizing of the target
- **TA-25**: A method for locating the SPG by fusing MRI and CT images
- **TA-32**: A procedure for treating headaches by blocking the SPG
- **TA-34**: An SPG procedure using an infrayzegomatic (lateral) approach
- **TA-43**: A framework for designing studies in relation to acute headaches
- **TA-44**: A method for treating headaches by blocking the SPG using local anesthetics and/or corticosteroids
- **TA-47**: Data relating to safety studies for using the MultiGuide device

Legend:
- **Very high**: 5
- **High**: 4
- **Moderate**: 3
- **Low**: 2
- **Very low**: 1

An assessment of the development maturity of each asset considering its planned use (pie indicates the relative share of assets in the field that has a certain development rating).
Characteristics of the IP portfolio

An image-guided device for surgical interventions which is adaptable for different applications.

A collection of working instrument and proximal pieces

An image-guided intervention device having a display cradle

Legend:

- Very high
- High
- Moderate
- Low
- Very low

An assessment of the development maturity of each asset considering its planned use (pie indicates the relative share of assets in the field that has a certain development rating).
Pipeline importance

Development level

Value for commercial offering

Assets that are highly valuable

A syringe for use with an image-guided device.

An image-guided device with an end piece for guiding an implant.

A method of locating the SPG without MRI image data.

Legend:

Very high

High

Moderate

Low

Very low

An assessment of the development maturity of each asset considering its planned use (pie indicates the relative share of assets in the field that has a certain development rating).
IPR-based control: Overview of control assessment for the asset portfolio

Valuable assets that are related to patent claims

<table>
<thead>
<tr>
<th>Technology Assets</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA-01</td>
<td>An adaptable intervention device</td>
</tr>
<tr>
<td>TA-05</td>
<td>A syringe for use with an image-guided device</td>
</tr>
<tr>
<td>TA-06</td>
<td>A collection of working instrument and proximal pieces</td>
</tr>
<tr>
<td>TA-07</td>
<td>A device with a proximal piece having adaptable compatibility</td>
</tr>
<tr>
<td>TA-08</td>
<td>A collection of end pieces</td>
</tr>
<tr>
<td>TA-11</td>
<td>An image-guided device with a slideable track</td>
</tr>
<tr>
<td>TA-28</td>
<td>A software for visualizing the position of a device and the target</td>
</tr>
<tr>
<td>TA-32</td>
<td>A procedure for treating headaches by blocking the SPG</td>
</tr>
<tr>
<td>TA-33</td>
<td>A procedure for treating rhinitis, rhinosinusitis, Frey syndrome or hypersecretion of tears by blocking the SPG</td>
</tr>
<tr>
<td>TA-34</td>
<td>An SPG procedure using an infrrazygomatic (lateral) approach</td>
</tr>
<tr>
<td>TA-40</td>
<td>The use of a surgical device for different intervention modalities</td>
</tr>
<tr>
<td>TA-41</td>
<td>The use of a surgical device by different medical specializations</td>
</tr>
<tr>
<td>TA-42</td>
<td>The use a surgical device for different target sites</td>
</tr>
</tbody>
</table>

Legend

- Technology assets potentially being patentable subject matter (see note on previous slide)
- Technology assets potentially being non-patentable
- Technology assets part of patents filed
- Technology assets partly described in existing patents applications.
Overview of patent status of technology asset portfolio

What do we do with these new patentable matters? – Contact a patent attorney!

Potentially non-patentable

Potentially patentable subject matter**

Parts of patent applications filed

Technology assets included:

Technology assets included:

Technology assets included:

Technology assets included:**:
Technology assets related to patent portfolio – example for illustrative purposes

**Overview of patent portfolio**

**WO2014037524:** Intervention Device

**WO2014037531:** Treatment of headache by injection of neuroinhibitory substance to the SPG or OG

**Community design**
Appl No: 001383897-0001-0010

**Invention disclosure (DOFI)**
XY intervention

**Invention disclosure (DOFI)**
YY procedure

**Invention disclosure (DOFI)**
XX procedure

**Technology assets related to claim of the patents**

<table>
<thead>
<tr>
<th>Number of technology assets</th>
<th>Value for commercial offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>8</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>7</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

Technology assets related to claim of the patents.

**Value for commercial offer**
- 1
- 2
- 3
- 4
- 5
Eksternal analysis

Development companies offering instrument and surgical procedure technology and associated IP

Surgical instrument and procedure developer

Actors offering instruments, consumables and accessories for MIS interventions.

Surgical instruments and accessories provider

Pharmaceutical actors offering neurotoxins for interventions, in particular related to migraine and similar indications.

Pharmaceutical provider (Neuroinhibitory)

Providers of HW/SW computer-assisted surgery systems enabling intra-operative image navigation.

Surgical navigation system provider

Source: CIT/NTNU TTO analysis.
**Eksternal analysis**

**Image-guided surgical intervention system**

**Intervention procedure**
- US20100227822 (Allergan)
- Targeted delivery of botulinum toxin for the treatment and prevention of trigeminal autonomic cephalgias, migraine and vascular conditions
- Using botox to treat migraine
- US2009214466 (Levin)
- Methods of alleviating disorders and their associated pain
- Targeting neurotoxins to SPG. But, the device can not be used for accurate injections, it is not suitable for neither endoscopic guidance nor image-guidance.

**Intervention instrumentation**
- EP2788073 (Medtronic)
- Introduction and anchoring tool for an implantable medical device element
- Similar application area, but different intervention
- US20140257340 (Boston Scientific)
- Tissue anchor with insertion device
- A medical device which may be used for biopsies

**Intervention navigation and localization**

**Main observations**
- Medtronic has a sizeable and strong patent portfolio, but appears to be specifically less relevant.
- Boston Scientific patents are more relevant, but fewer in quantity.
- Minimally invasive medical device is provided.
- Few relevant patent documents from Karl Storz.
- Allergan has a few patent documents on the use of botox for the treatment of migraine.

**Potential implications**
- As regards the intervention instrumentation field, a crowded patent landscape might implicate larger likeability of actor questioning the MultiGuide patents.
- As regards the intervention procedure field, patents relating to general uses of botox, botulinum type A, in the treatment of migraine and similar indications could potentially be relevant from to investigate additionally.
Eksternal analysis

Comments

- The number of patents identified are relatively high. The area is dense and with a spike in the number of submissions in 2012.
- The landscape seems to be pretty mature, and the last two years may indicate a drop in submissions although it is still high.
- Among the top 5, there are few surprises.
- Aspiring actors are industry 1, 2, 3 and 4
- Several players establishes itself by strategically move their patent portfolios into open patent landscapes.
Eksternal analysis

Patent portfolio comments

- Siemens manufactures and integrates products for surgical interventions, from software for pre-planning, software and systems for surgical navigation, data processing and manipulation, and intraoperative imaging.
- The portfolio focuses on software and data management, as well as physical products as imaging devices.
- There seems to be a poor match between MultiGuide platform and Siemens patent portfolio as no relevant instrument patents are identified and none related to headaches, migraines or ganglion.
- However, it may be possible be some interest of the assets such as the software for MultiGuide or the picture processing.

Patent portfolio overview

- Siemens total portfolio consists of over 600 patents most of which (258) are related to medical imaging.
- In terms of filing trends Siemens were most active between 2004-2008.
Eksternal analysis

Competing position

<table>
<thead>
<tr>
<th>Competitor</th>
<th>Communicated differentiation</th>
</tr>
</thead>
</table>
| Autonomic Technologies | • Stimulation of SPG offers a targeted, reversible and adjustable ability to control the devastating pain of cluster headaches.  
• Clinical studies that focused on evaluating efficacy, patient quality (outcomes) and security. |
| Sphenocath | • A new patented instrument and method to achieve SPG blocking.  
• Immediate effect, longer lasting, minimally invasive, gentle and comfortable for patients.  
• 5 minute procedure.  
• Very effective for adults, children and pregnant women.  
• Reimbursed by most insurance companies and Medicare.  
• Easy to perform for health care personell |
| Tian Medical | • Easy, safe, comfortable, precise and immediate access to Sphenopalantine foramen  
• Immediate migraine and headache effect  
• Long-term effect |
| Allevio | • No intervention. No needles. No drugs.  
• A faster, easier and more effective way of achieving an SPG block without using cotton swabs, needles or drugs.  
• A 15-minute procedure that results in both short and long term effects of chronic migraine patients |

Comments

• ATI seems to have a more objective, scientific and evidence-based communicative approach than the other three actors. Generally very few clear tools / benefits described in relation to the company neuro stimulator system.  
• In contrast, Spenocath, Tian Medical and Allevio focuses on essentially the same tools and benefits in their communicative approach.  
• All these three players focuses on three main aspects:  
  – Easy, secure and fast intervention (likely the most important for clinicians)  
  – The comfort during the intervention  
  – Immediate effect after intervention (probably the most important for patients)
IAM-based analysis facilitating Open Innovation in partnership projects

A methodology and a tool to characterize technology platforms, identification of potential partners and develop communications and control positions.

**Intellectual asset portfolio analysis**
- What are our most valuable intellectual assets?
- What control do we have over our intellectual assets?

**Industry and partner characterization**
- What does the industry value network look like?
- Who could be potential buyers based on patent portfolio relevance?

**IP recommendations and communication preparation**
- What additional IP would further strengthen our position and attractiveness?
- How to tailor communication to reflect strategic relevance for each actor?
Thank you

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Senior IPR manager, NTNU Technology Transfer AS