Mittuniversitetet
MID SWEDEN UNIVERSITY

Transforming the Industrial Ecosystem

A research, innovation and education vision

Executive summary

Transforming the Industrial Ecosystem (TIE) describes a vision for regional renewal and growth. It combines the industrial strengths of the Sundsvall region with the dynamic force that Mid Sweden University represents. The university attracts and educates young people to work in the region and sustain industrial competitiveness. Through its research and knowledge transfer the university facilitates renewal. When acting in symbiosis, the current industrial core and new businesses at its edges can become an effective ecosystem that continuously renews itself.

Transformative Technologies is a research environment formed of the research centres FSCN and STC that collaborate with a mixture of forest industry and ICT industry. Both centres are located at campus Sundsvall with shared facilities and joint research governance. This cross-sectorial research environment gives the initial identity to the transformative efforts by Mid Sweden University. The development includes education, research and innovation programs together with strategic partners, such as the city of Sundsvall, BioBusiness Arena and Fiber Optic Valley. Later on, a broader and even stronger engagement of the university is foreseen in the regional transformation.

The joint research program of FSCN and STC consists of large Strategic Actions. One part of these actions support competitiveness in the current core businesses of the industrial partners of either FSCN or STC, while the other part targets new innovations. Especially cross-sectorial actions, such as the industrial research college FORIC, are central for the development of a symbiotic regional ecosystem. Strong position in the national and international research and development community is also important. This is how research can best increase the attractiveness of the university and the region.

The TIE Vision is an initiative presented by Mid Sweden University to help to accelerate industrial renewal and regional growth. With focus on research, this document explains one way how this can happen. However, the vision itself covers much more than just research and addresses the entire region. Thus, the vision – if accepted – can be fulfilled only through systematic collaboration.

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Social and industrial challenges for regional development

The economy in the Sundsvall region has for two hundred years relied on industrial manufacturing of goods from forest resources. In the last fifty years the dominant product has been paper in different forms. Supplier and service industries have evolved with the local paper industry as their pilot customer. The suppliers and services include machine manufacturers, chemical suppliers, consulting service companies and, most recently, IT service providers. The significance of the service sector to the regional economy is comparable to that of the manufacturing industries. In 2010 Sundsvall was listed among the top 20 cities in Sweden regarding industry diversification.[1] There are an increasing number of new high technology companies that utilize information and sensor technology to innovate in areas such as process monitoring and control, security and living comfort as well as environmental applications.

In the last decade changes in the global economy and the national competitive advantages have changed the business environment for both the manufacturing and service sectors. The paper industry in the region thus faces a saturated or shrinking market and must do everything to improve its efficiency and at the same time develop new business. In IT services, the rapid acceleration of technology development challenges the resources of local providers. Irrespective industry sector, the refinement of manufacturing technologies and introduction of information technology have radically reduced the demand of traditional workforce. All industries in our region have difficulties in the recruitment of educated engineers who can work with advanced information systems, constantly improve operational quality and engage in the development of new revenue streams.[2]

An interesting development in our region is related to large investments in renewable energy i.e. wind mill power plants. In general, an increased use of distributed systems of renewable energy calls for better information service and resource allocation solutions. Thus, the development of smart grid solutions, within the plant or as part of the global grid system, will increase in importance. Thus, there is a growing need for engineers in the region working with renewable energy solutions, ranging from installation and service to optimization, development and research.

The key regional challenge shared by the industry and the society is to attract young people, educate them for the evolving labour market, and offer them an engaging environment to build their lives in. The importance of this challenge is demonstrated by the fact that the regional development goal is "*A region with living environment of world-class*". We believe that progress towards that goal requires an open attitude that

[1] Tillväxtfakta - Så växer Sverige och dess regioner, Tillväxtverket, p. 26. http://publikationer.tillvaxtverket.se/ProductView.aspx?ID=1387

[2]Arbetsförmedlingens prognos för 2011 och 2012: http://www.arbetsformedlingen.se/Om-oss/Statistik-prognoser/Prognoser/Prognoser/Riket/6-29-2011-Stark-arbetsmarknad-for-data--och-teknikyrken- .html

focuses on future opportunities and welcomes everyone who wants to contribute in her or his own way. In the market economy no one can steer the evolutionary processes or predict what the industrial ecosystem will be like in the future. For every new success story there are always many more initiatives that did not make it big. Creativity and entrepreneurial spirit are needed for the region to succeed in the global competition. If we all work for a better future, the old image of the Sundsvall region as the home-base of heavy manufacturing companies will be replaced by one where large and small companies form a symbiotic and dynamic industrial ecosystem. Our industrial graduate school FORIC[3] is a good example of this.

Industrial transformations are unavoidable. They may come suddenly and be radical: the whole production is closed down in one place and a completely new mill built in another, more advantageous part of the globe. The social cost of sudden transformations is very large. A gradual and sustainable transformation and development is obviously much better as alternative. It is possible if the existing industry can continuously improve its competitiveness. Since technology can always be bought, the key success factor is again competent people who can follow the global technology development, create knowledge and technical solutions for companies, and change opportunities to real applications.

Opportunities for industrial growth

In modern world real opportunities exist only in the global perspective. To be the best within a region is not a sustainable position. The abundance renewable raw material, renewable energy and pure water are real assets that offer global growth opportunities for the Sundsvall region. Better yet, the region has a long tradition of using these assets industrially in a manner that in fact gives answers to many of the Grand Challenges of the mankind. Specified in the Lund declaration (EU, 2009) during the Swedish EU presidency, these challenges are global warming, tightening supplies of energy, water and food, ageing societies, public health, pandemics and security.[4]

Many of the opportunities that arise from the Grand Challenges lie outside the traditional market segments of the region's industry, but it would be utterly foolish not to try to grab them when chances arise. In the best case, technology developed for the local or national customers finds much wider markets outside the initial sector and country. Having strong industrial customers at a short geographic and social distance is crucial for that development. In this respect, the continued presence and competitiveness of the local forest-based and allied industries is critical for the growth of other manufacturing and service companies.

[3] First intake of students from Frontway, Innventia, Mantex, MoRe Research, Pulp Eye, Ragn Sells, Sense Air, SCA, Skogforsk, Stora Enso, Sundsvall Energi, Sylvestris, Tärnsjö Garveri and Valmet

[4] Lund Declaration, "Europe Must Focus on the Grand Challenges of our Time", Swedish EU Presidency, 8, July 2009, Lund, Sweden [Online]

The second asset of the Sundsvall region is its vibrant consulting and ICT service industry. Today information technology, especially Internet of Things, is the key enabler of improvements in productivity and waste reduction. We believe that the interplay between industrial and consumer applications of information technology accelerates evolution in both of these markets. It is often argued that services are the only sector where European countries can compete globally. Thus, it is important to benefit from the growth potential of ICT in all sectors and leverage the attraction power that ICT has among young people who are interested in technology and natural sciences.

The third asset of Sundsvall is the education and research done by Mid Sweden University. We have two research centres that focus on industrial technology development; FSCN - Fibre Science and Communication Network and STC - Sensible Things that Communicate. The two centres have well-established co-operation with the forest-based and allied industries in the region, especially in helping companies to improve production efficiency. The centres also have significant collaboration with other industrial segments such as process technology, industrial IT, measurement and process control, and energy production and distribution.

Since 2012, FSCN and STC have been working to form one joint research environment that is now named Transformative Technologies. In line with the TIE Vision, this research entity has with a strong cross-sectorial character. Cross-disciplinary projects, shared facilities and common research governance mean that the joint forces of the over 150 experts of FSCN and STC can be focused to make a powerful contribution to regional renewal and industrial growth. Development is in progress to learn to join this force with the innovation systems of BioBusiness Arena and Fiber Optic Valley. The combination has the real potential to become strong part of the regional growth and innovation engine.

Attracting talent

This is the key challenge for all parties, even for the research, education and innovation environment of the university. The most important task of a university is to educate people who want to use their knowledge and skills to the benefit of the society at large. Even in research the most characteristic “product” of an academic institution is a well-educated researcher or expert. One cannot develop academic research if one cannot attract talented students. Difficulties in this respect also affect Mid Sweden University. The university wants to perform better in attracting undergraduate and graduate students to relevant areas such as chemical engineering, chemistry, electronics, engineering physics and information technology. These are the key competences needed in our research and in the industrial ecosystem alike.

Within the research, education and innovation environment, we are helping companies by developing continued education so that their personnel can keep up with the technological revolution that information technology, especially Internet of

Things, causes at the workplace. However, this is only a partial solution because it does not attract new people. We believe that the university can do better than before in attracting students and hence serving the society and industry in the region, but this requires profiling the most *exciting* rather than the most *relevant* research and education opportunities. The attractive opportunities include the ICT sector as a whole, renewable energy, bio-based products and industrial design. In our context industrial design refers to the education and research into methods that secure the usability and accessibility of products and services – a key dimension in any development work.

We also believe that the dynamics and open spirit of the campus, the city and the region at large is important for young people. When young, one wants to do "own things" rather than just accept what "elders" say. The younger generation are attracted by meaningfulness and are more attracted to problem solving than disciplinary excellence. This is in-line with the current scientific understanding on how educations should be arranged[5].

Research opportunities

Success in the sustainable transformation and development of the industrial ecosystem relies on our ability to foster an open environment that goes beyond the starting point of renewable raw materials, renewable energy and pure water. The transformation must involve both competence development in the core of the existing industrial value chain as well as at its edges where completely new business is created. There is a classical tension between the Core and Edge perspectives in industrial development, discussed by Hagel and Brown[6]. They conclude: "*In particular, we must regrind our lenses to monitor the periphery, that is, the edges, of our business. At these edges lie our richest opportunities for value creation and our strongest protection against value destruction.*"

As stated earlier we envision a gradual industrial transformation rather than a disruptive change. We believe that gradual transformation is necessary in order to take advantage of the current strength that we have in the region. We address this challenge in our strategic approach by specifically forming research programs for both the Core and the Edge (see Fig. 1).

[5] Popper, K. R. Conjectures and Refutations: The Growth of Scientific Knowledge. New York: Routledge and Kegan Paul, 1963, p. 88.

[6] Hagel and Brown, The only sustainable edge; why business strategy depends on productive friction and dynamic specialization, Boston (Mass.): Harvard Business School, cop. 2005

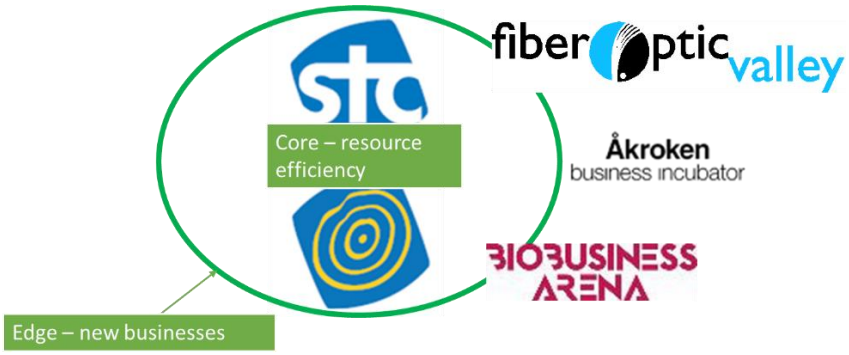

Figure 1. Starting point for the research and development of Transformative Technologies at Mid Sweden University.

Within the joint research environment Transformative Technologies, the centres FSCN and STC have specific research areas that are relevant to the respective industrial sectors, and common areas that cut across sectorial boundaries. We have above presented a holistic analysis of the challenges and opportunities for the research, education and innovation environment of Mid Sweden University. When combined with the competences of the two research centres, this analysis points out research themes that support industrial transformation and at the same time respond to the Grand Challenges of mankind. These selected research themes are formulated as Strategic Actions[7].

When selecting the research content to the Strategic Actions, we apply the following six guidelines that summarise the analysis above:

1. Exploit the competitive advantages of the region
2. Choose opportunities from a global perspective
3. Use information technology as a key enabler
4. Adapt to changing markets
5. Supply competence and skills
6. Profile the most exciting future opportunities

Long-term goals for Mid Sweden University

Mid Sweden University contributes through its research, education and innovation environment to the sustainable transformation and development of the regional industrial ecosystem. Success is measured by its ability to attract young people to the

[7] Currently we have seven Strategic Actions: Energy-Efficient Mechanical Pulping, Large Functional Surfaces, Embedded Industrial Sensor Systems, Forest as a Resource Industrial Research College, Measurement Systems, and New Cellulosic Materials

educational programs and stimulate them to continue in to the research, new business creation or established industry of the region. The future ecosystem is characterized by symbiotic dynamics between different kinds of enterprises, including the major manufacturing companies that today operate in the region. The Mid-Sweden University environment is a functional part of a larger regional innovation network of industrial and public actors.

In this development the Mid-Sweden University will work strategically to form long term alliances with external partners such as funding organisations, industrial networks and research partners in academia and institutes. In the first phase the goal is to consolidate the research environment Transformative Technologies that combines the two research centres FSCN and STC. Later on, a broader engagement of the university is expected. In the following table we list strategic funding partners and their role in the long term development of the environment.

Organisation	**Contribution and support**
Knowledge Foundation	Support for research in collaboration with strategic industrial partners. Knowledge development and competence exchange and training.
Vinnova	Support for innovative research, verification of innovations, funding for innovation coaching and innovation networks, research program supporting groundbreaking and disruptive initiatives.
BioBusiness Arena, Fiber Optic Valley, Åkroken Business Incubator	Innovation systems that connect us with industrial networks of small and large companies and enable our support to the creation of new businesses.
VR, SSF, Formas	Support for path-breaking academic research.
Tillväxtverket (ERUF)	Development and innovation funding for regional development. Research and development with focus on regional growth.
Municipality, County	Collaboration and funding to establish important research infrastructure, strategic recruitment of key competences, and innovation support and branding.
EU (H2020)	Funding for international exchange, networking and strategic partnership.

The long term goals can be divided into organisational, scientific, collaborative and innovative goals. The Knowledge Foundation has instruments to address a large part of the goals. However, there are some important aspects that do not fall within the

programs of the Knowledge Foundation. Nevertheless, we have formulated a strategy that includes the wider perspective and we believe that it is important to communicate the overall strategy and goals as one entity even though we are aware that some aspects may be out of scope for a particular funding organization.

In the following table we list the long term goals for the Joint Research Environment of FSCN and STC including interdisciplinary research activities, education and innovation programs.

Long term goal – 10 years perspective	**Strategic funding partner**
Resources: The environment has attracted the research competence needed to stand strong as an attractive research institution in the selected profile area. (TIE 1, organisational)	Knowledge Foundation, EU, Sundsvalls kommun, Västernorrlands Län, Tillväxtverket
Leading: The environment is regarded as one of the leading research and innovation locations in the targeted area. The research has a strong influence in the research community as well as in important industrial networks. Large visibility at the most important conferences, well recognized publications and established contacts to the most important competence environments. (TIE 2, scientific)	Vinnova, VR, SSF, Tillväxtverket, Sundsvalls kommun, Industrial companies (national and international), Knowledge Foundation, EU
Start-ups: The environment attracts business angels and venture capital investing in new ventures from our research and education. (TIE 3, collaboration and innovation)	Innovationsbron, Vinnova, Business angels and venture capital, industrial contracts
Education: The education programs related to the environment is attractive and young students compete to take part in the development. Well established master by research education in collaboration with leading industrial networks attracts good international students from all over the world. (TIE 4, organisational and collaborative)	Partner industries and industrial networks, partner universities (ex KTH, SLU, Umeå University)
International: The environment attracts international collaboration and exchange programs with leading academic institutions and leading industry. The environment takes part in shaping the future research agenda for both national and international research programs. (TIE 5, scientific and collaborative)	EU Horizon 2020, Vinnova, STINT, EU Interreg

Internal leadership and regional co-operation

Achieving the vision requires a combination of internal and external leadership and co-operation. At the university, the management structure of a joint research

environment is needed for internal coordination and development of synergies over faculty boundaries. However, the transformation described here concerns the opportunities offered to all the different actors in the Sundsvall region if their development efforts can be aligned. By sharing a common vision of transformation the regional leadership can act to enhance synergies and align development efforts of public organizations, private companies and academia (Fig. 2).

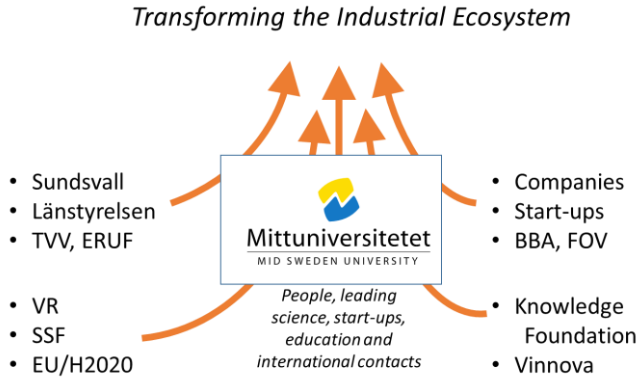

Figure 2. Key actors in the implementation of the transformative vision.

The university can offer many contributions to the implementation of the vision. These include the ability to acquire research and innovation funding that benefits also the private companies and public companies of the region. The university has started the development of a regional research and innovation agenda including competence delivery. Details of the actions needed to achieve the vision are successively evolving and sharpening. The university and the city of Sundsvall have joined forces to provide seed capital for innovative research with transformative potential. The joint agenda promotes collaboration within the region and cities surrounding Sundsvall.

Important partners in the development are the innovation clusters Bio Business Arena, Fiber Optic Valley and Processum. They provide an arena for broad strategic discussions and innovation development with companies and can facilitate infrastructures for transformation. The seed funds raised jointly by the university and the city of Sundsvall have been used to initiatives that may become large research, competence development and innovation programs supported by the county and the regional funds of EU. One way to increase the engagement of companies in such programs could be through the platforms of BioBusiness Arena, Fiber Optic Valley and Processum.

Finally, we are teaming up with national and international initiatives that are in line with our strategic agenda and that are sharing our interest for transformative research and development.

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