Road2Science & Co present:

THE GM AGENDA

A Swedish Strategic Research and Innovation Environment
Vision 2013 - 2030

ATTENTION:
This document specifies the GIMI Agenda developed for a National Swedish Strategic Research and Innovation Environment over the period 2013 - 2030.

As this document has been developed over a year's time in collaboration between many stakeholders, it includes all the background thoughts and motivations that resulted in the GIMI Environment and integral GIMI Agenda. Since we are not sure if this document will be read as a separate document or together with Attachment 1 ('Strategic Innovation Area Programme Description') we have not removed the GIMI Environment description, which can thus be found in both documents. In case you have read Attachment 1: please feel free to skip the GIMI Environment description in this document and focus on the GIMI Agenda description, the GIMI Road Map timeline and milestones, the detailed GIMI Strategic Sub-Environment descriptions, its Management Structure, the Impact Assessment, the development process, the Key GIMI Visionaries and the GIMI Research clusters.

Table of contents

Kort sammanfattning av GIMI området

Sverige satsar årligen 90 miljarder kronor för att bygga och underhålla det nationella infrastrukturnätverket. 1,2 miljoner lastbilslaster transporterar varje år material till infrastrukturbyggande. Det är nu dags att göra infrastrukturbyggandet mer effektivt och grönt i Sverige. Det finns en enorm potential i att skapa ett väl fungerande och långsiktigt hållbart miljövänligt infrastrukturnätverk. Ett väl fungerande transportnät fungerar också som en drivkraft för en ekonomisk tillväxt i Sverige och hjälper till att attrahera internationella företag. Detta ger Sverige en kraftigt ökad konkurrenskraft som har en internationell betydelse. Det pågår idag en omfattande forskning på universitet och utveckling inom industrin avseende högteknologiska material, smarta ICT-lösningar, nya miljövänliga fordon och lösningar. Det är därför av yttersta vikt att det i Sveriges transportinfrastruktur inte saknas miljövänliga innovationer. För att uppnå en ökad grad av innovationer och konkurrenskraft måste man kunna implementera de senaste innovationerna i industrins verksamhet samt bli en drivande kraft i utvecklingen av ny teknik. Traditionellt, har infrastruktursektorn aldrig varit speciellt förtjust i ny teknik då industrin i allmänhet vill minimera risker i sin verksamhet. Med en förändrad funktionalitet i infrastrukturen i framtiden är det nu dags att se till att infrastruktursektorn moderniseras och omfattar en ökad grad av innovationer i näringslivet. Infrastruktursektorn ska bli en motor för att Sverige i framtiden ska bli ledande inom hållbart samhällsbyggande.

KTH har därför i samarbete med Svensk industri skapat ett program för det strategiska området ”Green Infrastructure Material Innovation” (GIMI). Genom GIMI-området kommer intressenterna att samarbeta med en gemensam vision för framtidens hållbara infrastruktur. Forskare inom GIMI kommer att driva fram kunskapen, Industrin kommer att implementera kunskapen och använda kunskapen för ökad konkurrenskraft. De kopplade Standardiseringsorganen kommer att tillhandahålla de stödjande standarderna och reglerna samt ett starkt nationellt och internationellt nätverk för spridning, kommunikation och tvärvetenskaplig samverkan. GIMI har en ambitiös och långsiktig agenda med många aktörer. Det är därför viktigt att samarbetsklimatet är sådant att specifika mätbara in- och utdata kan definieras och verifieras. Dessa in- och utdata baseras på ”Knowledge Triangle”. Agendan är uppdelad i 11 st ”Strategic Sub-Environments” (SSEs): **SSE-0 GIMI kommunikation, SSE-1 GIMI öppen plattform**, **SSE-2 GIMI COOP program**, **SSE-3 GIMI mötesplatser för akademi och industri**, **SSE-4 GIMI forskningsprogram**, **SSE-5 GIMI Online kursprogram**, **SSE-6 GIMI standardisering**, **SSE-7 GIMI utbildning**, **träning och simulering**, **SSE-8 GIMI strategiskt partnerskap**, **SSE-9 GIMI demonstrationer och SSE-10 GIMI spridning & exploatering**. Varje SSE har sin egen koordinator med en erkänt hög teknisk och administrativ kompetens med omfattande erfarenhet av samarbetsprojekt. Till varje SSE finns en kompetent ledningsgrupp. GIMI-området organiseras och samordnas av GIMI:s ledningsgrupp. Det finns två referensgrupper: 1) GIMI:s nationella referensgrupp och 2) GIMI:s internationella referensgrupp. Dessa två referensgrupper säkerställer att GIMI-området blir övergripande i sitt arbete, är insatt och medveten om nationell och internationell verksamhet inom området samt identifierar och föreslår nya verksamheter eller strategiska medlemskap. De finansiella resurser som krävs för GIMI:s agenda beräknas uppgå till 28 MSEK under det första verksamhetsåret (2013-2014) och 32 MSEK under andra verksamhetsåret för att utveckla de aktiviteter och mål som framgår av GIMI:s roadmap. Efter 20 år (2030) beräknas GIMI vara helt självförsörjande utan behov av extern finansiering. Efter detta kommer GIMI att skapa egna vinster eftersom egengenererade intäkter och parternas bidrag kommer att täcka kostnader inom GIMI:s agenda: De framsteg i innovationer som kommer fram skapar konkurrensfördelar för medlemmarna och för Sverige.

GIMI-visionen är ambitiös, utmanande och spännande. Den samhälleliga vinst som GIMI har är inte bara att optimera ett flertal arbetsprocesser, verktyg och produkter. GIMI handlar också om att skapa en förändring av tankesätt inom svenskt infrastrukturbyggande. Idag har Sverige en nationell expertis och en infrastrukturkapacitet för att skapa framgångsrika ”GIMInnovations”, att genomföra dem i praktiken och göra dem till svenska exportprodukter. Som nation är Sverige tillräckligt litet för att agendan ska kunna förena alla dess intressenter till en gemensam vision och tillräckligt stort och innovationsdrivet för att dessa effekter får stor påverkan för Sverige. Den nuvarande situationen för internationell transportinfrastruktur är sådan att om Sverige utvecklar GIMI-agendan idag, blir vi en nation som är internationellt ledande när det gäller gröna innovationer inom infrastruktur och utvecklingen av framtidens gröna infrastrukturmaterial. Detta innebär att Sverige genom GIMI får möjligheten att sätta den globala dagordningen för hållbarhet i framtiden.

Summarizing the GIMI environment

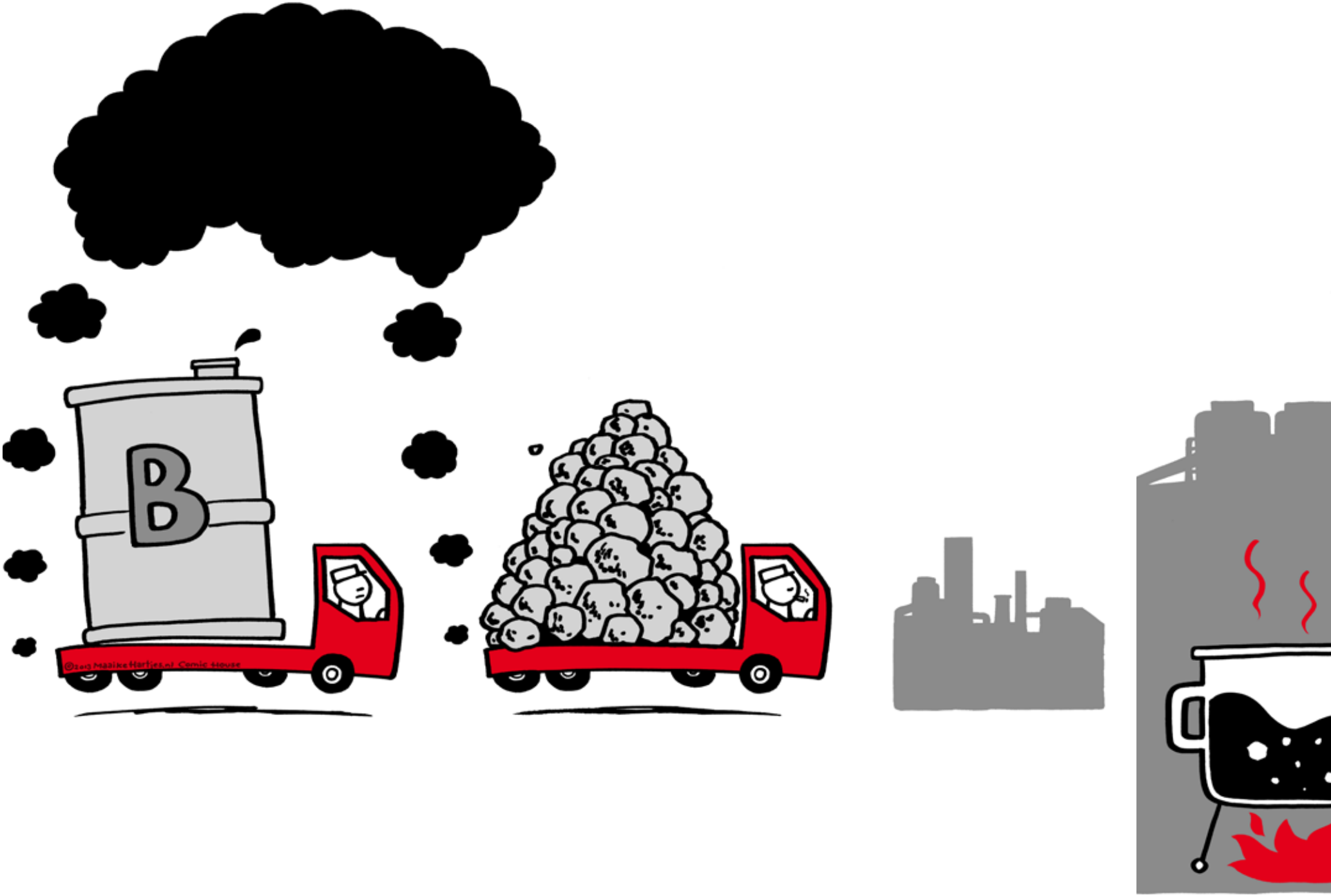
With 90 billion SEK in annual expenses to build and maintain the national infrastructure network consisting of asphalt, concrete and steel, and with 1.2 million truck loads being driven around to transport infrastructure material, Sweden has a tremendous potential to transform the traditional infrastructure sector into a green one . The importance of a sustainableand dependable infrastructure network goes far beyond these numbers alone. A thriving transport infrastructure network functions as the driving force for further economic growth and helps to attract international ventures, making it a national strategic asset. Given the current pace of inventions in high-tech materials, ICT solutions and environmentally friendly vehicles, it is of utmost importance that our transport infrastructure itself is not lacking behind in environmentally friendly innovations. For this, it must be able to implement the latest innovations into practice as well as to become a driving force in new technology developments. Traditionally based on minimizing risks, the infrastructure sector has never been keen on new technology. With future functionalities on the doorstep, now is the time to ensure that this sector will modernize, embrace and drive innovations in its sector.

For this reason, KTH, in collaboration with the Swedish industry, is proposing a National Strategic Research and Innovation Agenda on Green Infrastructure Material Innovations (GIMI). Stakeholders in the infrastructure sector will collaborate in a GIMI environment with a shared vision: Scientists to drive the knowledge, industry to apply the new technology, standard setting bodies to provide the supporting standards and policies and a strong (inter)national network to allow for dissemination, communication and cross-disciplinary interactions. Since GIMI is an ambitious agenda with many stakeholders, it is important that the environment is shaped in such a way that specific measurable in- and outputs can be defined. For this reason the Agenda is divided into 11 Strategic Sub-Environments (SSEs): the **SSE-0 GIMI Communication**, the **SSE-1 GIMI Open Platform**, the **SSE-2 GIMI COOP Program**, the **SSE-3 GIMI Academy Industry Meeting Days**, the **SSE-4 GIMI Research Program**, the **SSE-5 GIMI Online Course Program**, the **SSE-6 GIMI Standardization**, the **SSE-7 GIMI Participatory Simulation Training,** the **SSE-8 GIMI Strategic Partnerships**, the **SSE-9 GIMI Demonstrations** and the **SSE-10 GIMI Dissemination & Exploitation**. Each SSE has its own coordinator, selected on acknowledged technical and managerial expertise and extensive experience with respect to collaborative projects, its own Management Team and membership base. The GIMI Management Team coordinates the GIMI environment guided by two reference groups: the GIMI National Reference Group and the GIMI International Reference Group. These reference groups ensure that the GIMI environment is inclusive in its views, is aware of other national and international relevant activities, and suggests new activities or strategic membership(s). The overall financial resources required for the GIMI agenda are estimated at 28 MSEK in its first operational year (2013-2014), increase to 32 MSEK in its second year and continue to evolve as more activities are developed following the GIMI Road Map. After 20 years (in 2030), GIMI is estimated to be running without the need for external funding, since the self-generated revenues and partners contributions will match the costs associated with the GIMI agenda.

The GIMI vision is very ambitious, challenging and exciting. The societal impact that this agenda could have is reaching beyond optimization of a number of processes, tools or products. GIMI is about establishing a paradigm shift in Sweden's infrastructure sector. At this moment in time, Sweden has the in-house expertise and infrastructure capacity to successfully create GIMInnovations, implement them into practise and make them into Swedish export products. As a nation, Sweden is small enough that the agenda can unite all its stakeholders into a common vision, and large and innovation-driven enough that its impact will be significant. The current constellation of the international transport infrastructure sector facilitates that if Sweden embraces the GIMI agenda today, we will become a front-running nation in Green Infrastructure Material Innovations tomorrow and, as such, have the opportunity to set the agenda globally.

What *are* GREEN Infrastructure Material Innovations?

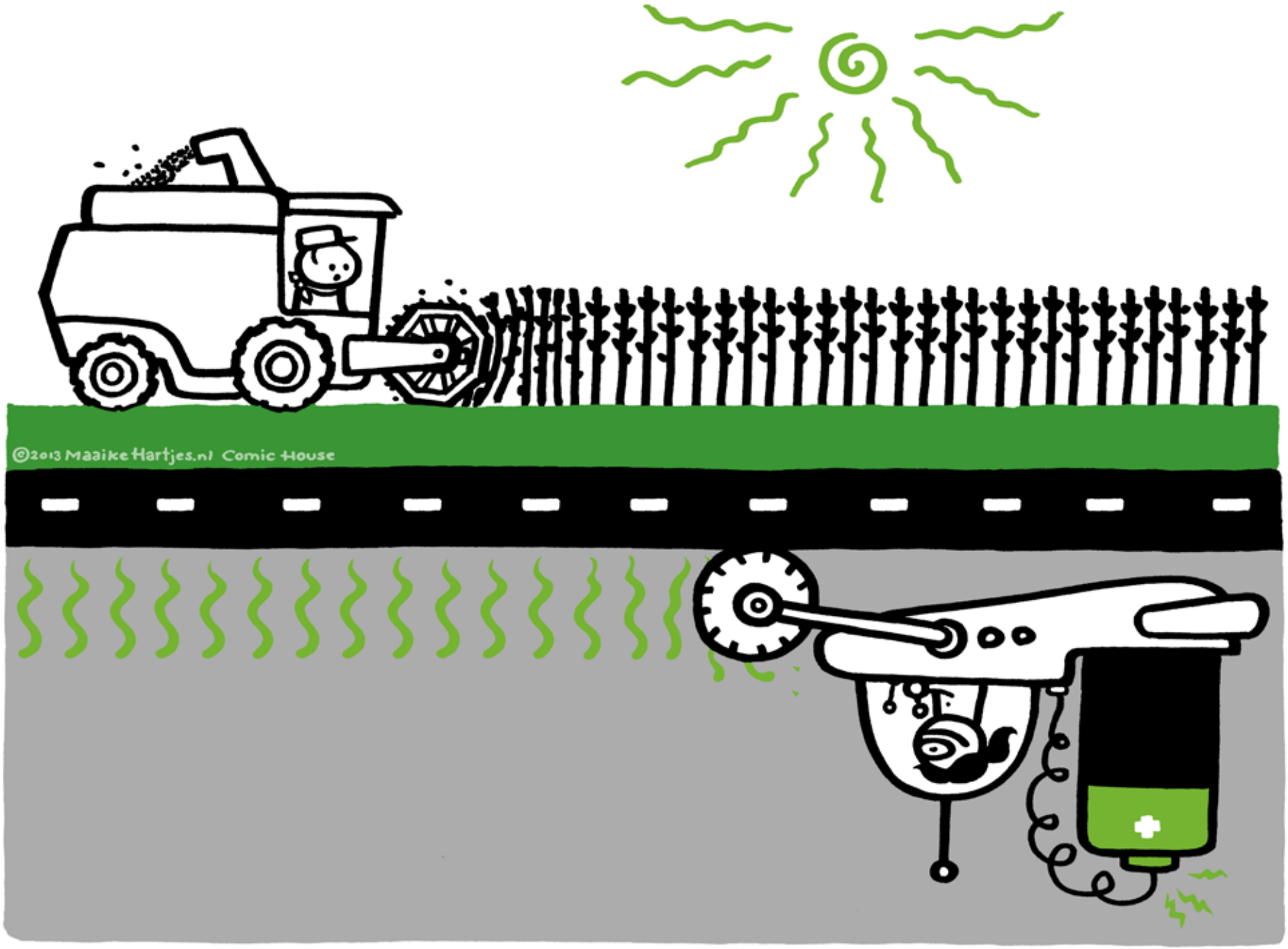
(...as opposed to non-green)

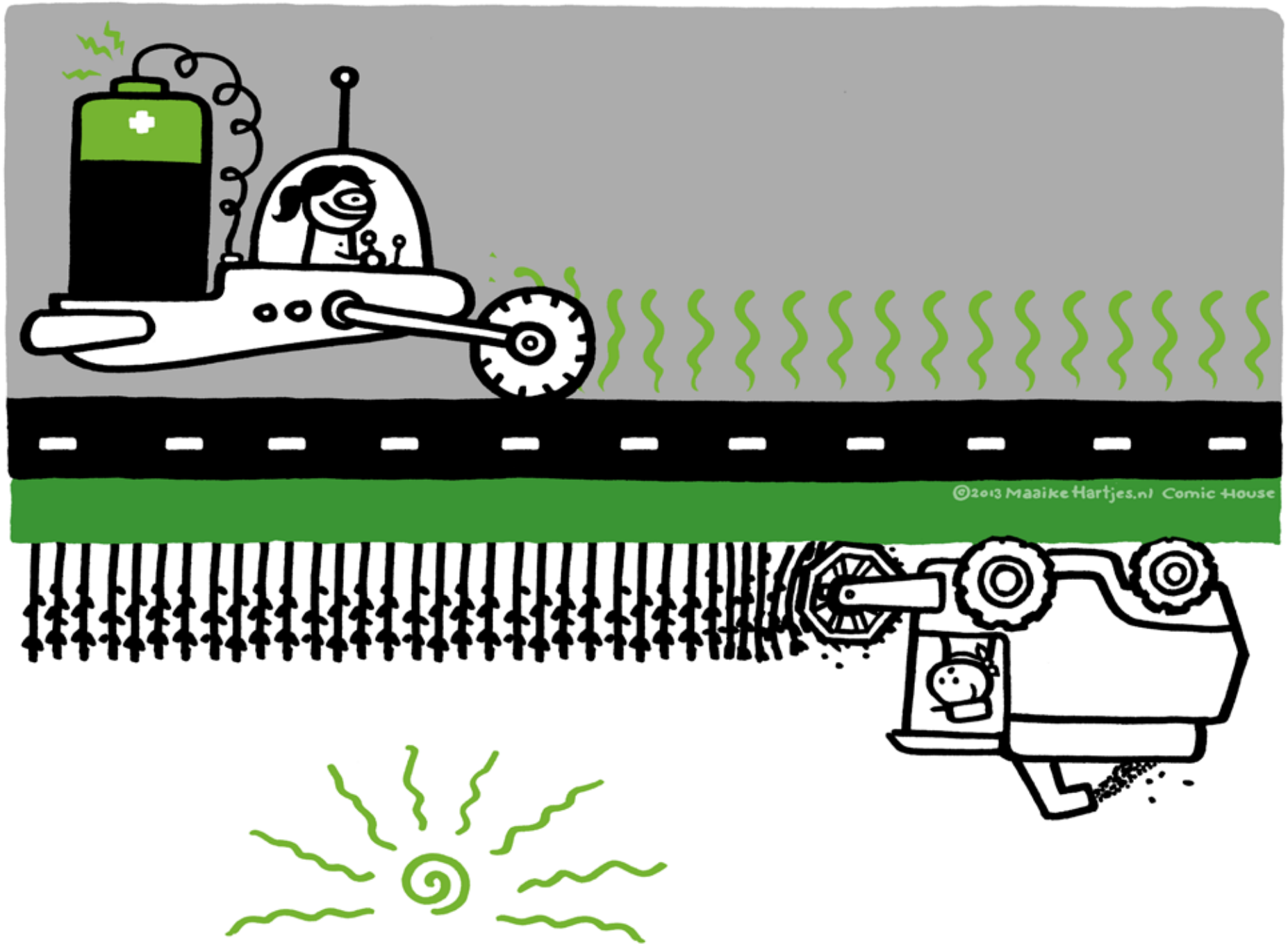

B


B
©2013 Maaike Hartjes.nl Comic House

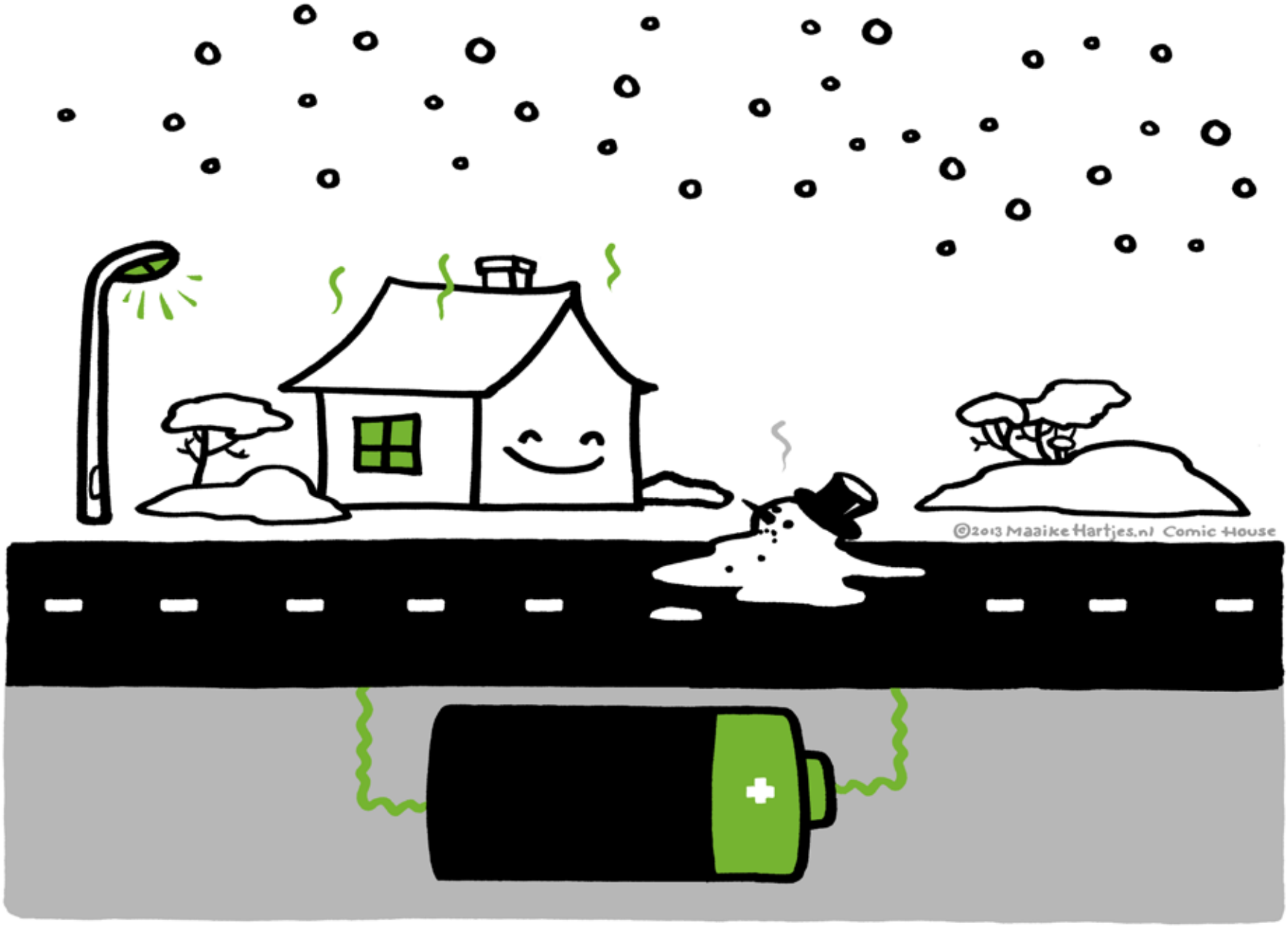

©2013 Maaike Hartjes.nl Comic House

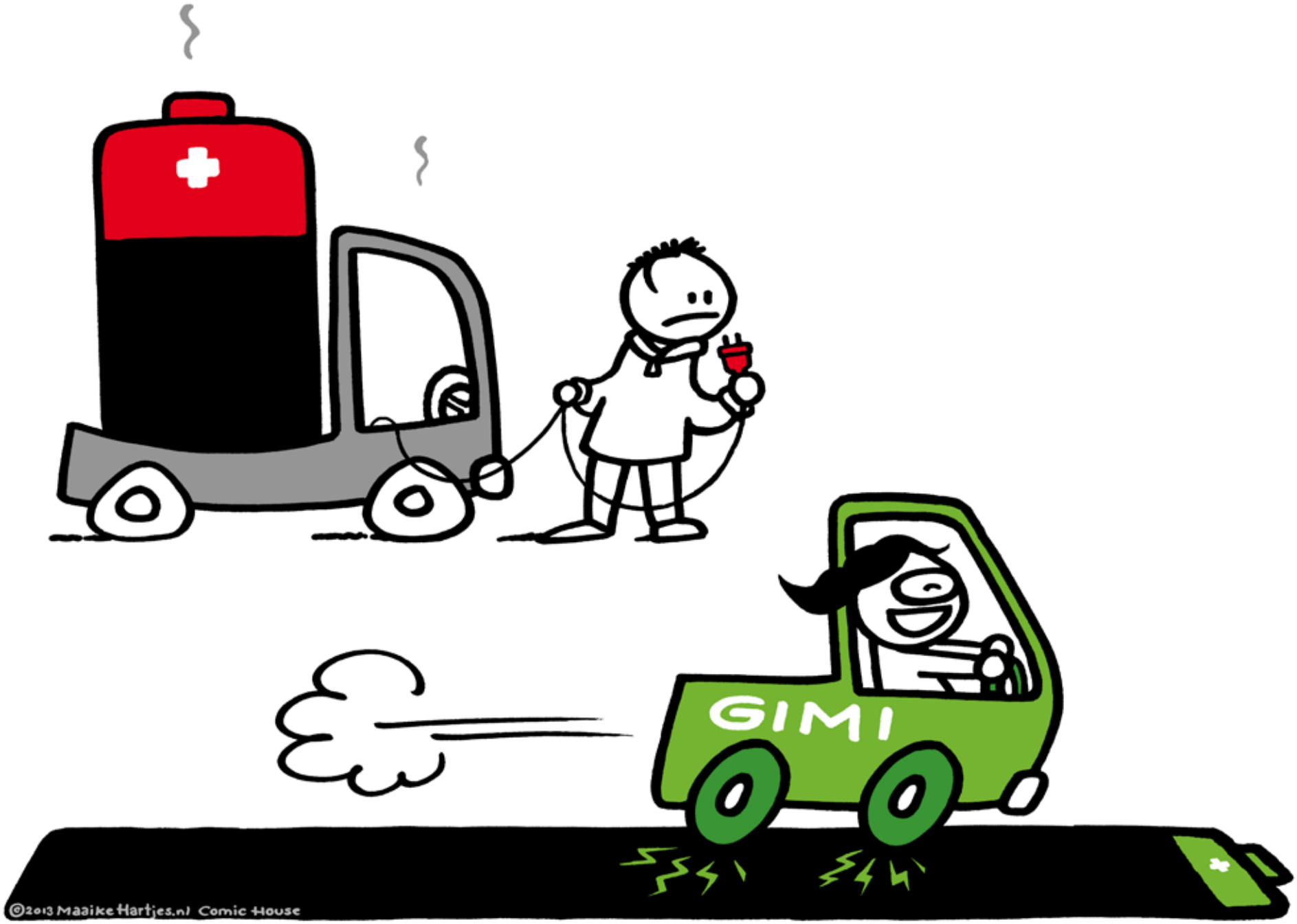
What are Green Infrastructure Material Innovations?


©2013 Maaike Hartjes.nl Comic House



What are Green Infrastructure Material Innovations?


©2013 Maaike Hartjes.nl Comic House



What are Green Infrastructure Material Innovations?

‘Green Infrastructure Material Innovations will revolutionise the way *our next generation* thinks, feels and lives sustainability’

When Thomas Edison discovered the lightbulb, he provided our society with illumination to perform functions at any time that had previously required daylight. But his discovery did not only bring light to darkness, it also lightened the way to otherwise unforeseen frontiers such as movies, television, computers, copy machines, fiber optics, medical procedures, tanning beds and even heat sources at buffets. Before the invention of the lightbulb, people could not imagine the incredible rich and varied developments that would stem from it. Children born today enter a world filled with computers, the Internet, smartphones, text messaging, jet planes and hundreds of TV channels. The legacy *we* leave them is *their* point of departure. They can no longer imagine a world where phones used to be bolted to the wall and people were sending each other cassette tapes over postal mail to share music. Their generation starts with the intelligence of smartphones, the speed of the internet and the connectivity and information sharing of social networks.

Imagine now a world in which it is normal that when you drive over a road, energy for the surrounding neighbourhoods is generated, without producing any fumes or green house gasses. Imagine that there will no longer be emissions coming from the construction and maintenance of our infrastructure and that roads are seen as the green blood veins for our sustainable society. If that is the level of the infrastructure our next generation starts with, they will not even conceive of building a road without considering the environmental impacts. They would not phantom first heating material to then cool it down again. They would resist hauling material from overseas and instead always seek for local materials and thus avoid wasting energy and creating emissions. They will be so used to thinking, feeling and living sustainability that the inventions of their generation will consider it unethical for a new invention to not be greener, thus more sustainable and environmentally friendly, than yesterday’s solution. Just like our modern day society now understands that slavery and racism are unethical, the new generation shall think, feel and live sustainability in every aspect of their lives and acting any other way would feel unethical to them. This is what a Swedish innovation agenda can establish.

But why focus on infrastructure in a national innovation agenda? Why not focus on making our computers faster or changing the way we build our cars? The answer to this question is surprisingly straightforward: the market has already understood the benefits of doing these latter developments. Their industries have enough incentives to develop faster computers and better cars. Competition and international momentum in these fields ensure continuous development at a rapid pace. The transport infrastructure sector has, however, not reached such a stage. Road contractors, stone quarries, asphalt and cement plants, trucking companies, road authorities and all associated industries have not embarked on the collective road to sustainability yet. The way our infrastructure is procured, built and maintained today is -almost- identical to previous centuries and does not consider being green as a primary focus. The road infrastructure, in many ways, is still making phone calls using the bolted phone on the wall. Yet, the Swedish stakeholders are increasingly interested in making a change and the technologies that would allow for such a change are emerging. It now takes *strong leadership* to create focus and maintain momentum to remove the sector’s resistance for change. It takes a protective *environment* to create an incentive structure that will empower the individual stakeholder. It takes a *country* in which collaboration runs through it’s peoples veins and where innovation is part of every day life. It takes a *common vision and guts* to develop the road’s lightbulb. It takes **GIMI**.

Why focus on Green *Infrastructure* Materials ?

(...as opposed to materials in general)

The national investment

Every year, Sweden invests 75 billion SEK into building new road- and railway infrastructure. On top of this, the current infrastructure needs to be maintained, which adds another 9 billion SEK for roads and 8 billion SEK for railways. So, for over 90 billion SEK in annual expenses, it is fair to state that our infrastructure is in fact a significant national investment.

The importance of a sustainable, well-functioning and long-term environmentally friendly infrastructure network goes, however, far beyond these costs alone. A thriving transport infrastructure network also functions as a driving force for further economic growth and helps in attracting international ventures, making it also of international importance.

Given the current pace of inventions in high-tech materials, ICT solutions, new environmentally friendly vehicles and solutions, it is of utmost importance that our transport infrastructure itself is not lacking behind in environmentally friendly innovations. For this, it must be able to implement the latest innovations into practice as well as become a driving force in new technology developments.

Given the changing global philosophy and growing collective environmental responsibility of today's society, the use of sustainable and energy preserving materials that diminish global CO2 emission has become of imminent urgency. Considering the material volume involved with the transport infrastructure sector, an enormous gain can be made if we are able to systematically introduce Green Infrastructure Material Innovations (GIMI) to the market:

- Giving our industries the tools to optimise their supply chain operations...
- Enabling the use of new materials that minimize the green house gas emissions, the wasteful use of base materials and energy expenditure....
- Including a green perspective from life cycle based procurement to enhanced durability with high rest values long after the economic life is over...
- Making our infrastructure a source of energy rather than an expenditure...

This will bring our national investment to a new level of sustainability and will make Sweden a forerunner on a global scale.

'Sweden's *1+1>2 principle* is ideal for GIMI'

A new paradigm

Sweden today has already a strong presence in the infrastructure field: from our expertise on recycling of road materials, to the explosion experts in the stone quarries, to the cold mix asphalts that were developed in the late 80ties: a Swedish road contractor equals quality and reliability in foreign countries. But that is not all. The Swedish transport infrastructure sector is unique in the closeness of the individual people, their open communication styles and their affinity to being part of research projects. This makes Sweden today a unique place. When the rest of Europe is suffering under the economic crisis and the USA cuts back on all their previous advances in leading the infrastructure market, Sweden is investing on many fronts. With KTH Royal Institute of Technology now leading in volume and vision in the field of transportation and materials research, with Chalmers' SAFER Center becoming world known for its transport safety research and with the SP Technical Research Institute of Sweden having strong roots throughout the country for their material characterization, the academic power that is collected in Sweden today is truly remarkable. Internationally, the Swedish transport authorities and industries are known for their openness toward innovation and are frequently invited on the international development scene. The Swedish standards setting authorities are embracing the new innovation based performance standards and are starting to have leading roles in many of the European committees.

By having a united agenda these players can show that 1+1>2 and, as such, significantly raise the Swedish international competitiveness in this sector.

A Socio-technical system

Given the large annual investments, the willingness of the Swedish authorities, the academic excellence and the entrepreneurial companies, why does the infrastructure sector not innovate *itself*? Why would there be a need for a national agenda to push the developments? To answer these questions, we first need to be asking ourselves *why* today we still procure, design, build and maintain roads the same way as we always have? From the Appia road and chariot

wheels dating back to the Roman Empire, the road and rail infrastructure have certainly not made the same evolution as the telecommunications or the vehicle industry have. The vehicles that drive over our roads have indeed changed, but aggregates, cement, sand and bitumen are still the main ingredients of infrastructure construction, how we produce and transport our material is still based on the same principles and the price of oil and energy is still driving the costs in the infrastructure sector.

So what explains this lack of innovation and why has there not been an inherent need for innovation? Many answers could be given to this question. Some may argue 'if it ain't broken don't fix it': we do today have *functional* roads and are able to provide sufficient mobility to our society. Others may say that the industry drives on 'gut feeling' and has always felt comfortable with 'business as usual'. New materials and new construction methods would inevitable lead to *unknown risks* and a need for changes throughout the supply, production and construction chains.

The latter could in fact explain a large part of the puzzle. The infrastructure sector is a complex socio-technical system in which changes in technology or methods imply new structures for 'doing business' that affect more components of the sector than technically required. Since most innovations do not come with an integrated approach for alignment of the change in the institutional and social space and merely focus on technical aspects in the product space, most new technologies in this industry are in fact set to fail from the very beginning....

Treating the infrastructure sector as a complex socio-technical system in which the institutional, social and product space are addressed coherently may bring about a change in transferring innovations from the academic laboratories to the construction sites. But what would create the incentives for the sector to indeed start on this new journey? The answer to this may lie, in fact, in the 'if it ain't broken don't fix it' idea. What if very soon *it will be broken*? What if it already is? And it is not potholes and cracks we should be thinking about, it is in fact the *functionality* of the infrastructure that will soon no longer suffice for our modern day world.

5 Reasons for the GIMI Agenda...

1. Sweden spends over 90 billion SEK/year on road- and rail-infrastructure that can become a green investment
2. Anchoring Green Infrastructure Material Innovations helps making Sweden a Sustainable Society
3. It places Sweden on the forefront of driving a Resource Efficient Europe
4. A green Swedish transport infrastructure steers a positive momentum in other sectors
5. Sweden currently has the in-house excellence and willingness to become a Global Leader

‘The infrastructure will soon be providing functionalities far beyond mobility only’

Changing functionalities

Mobility of people and goods has traditionally been the main function of roads and rails. Even though this will always be the major task of the infrastructure, it may no longer be the only one. Looking for instance at the developments in the ICT and car industry: Car2X communication developments are building momentum at a fast pace. Very soon, these will be ready for implementation and it is exactly that moment when the infrastructure is going to be broken. Because the ‘X’ will often be the ‘road’....

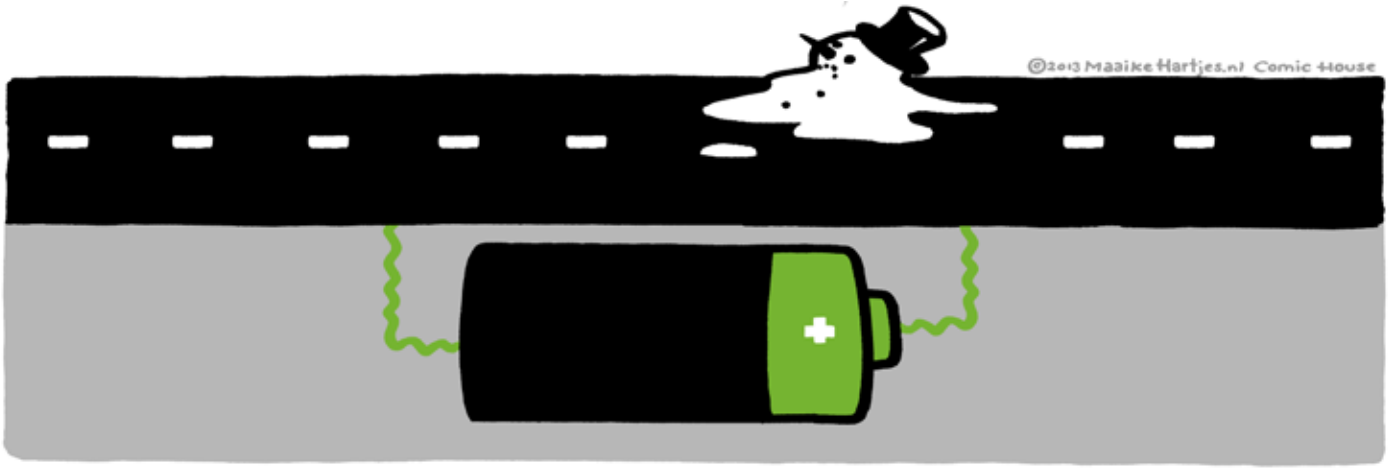
Communication between the infrastructure and cars (or the infrastructure and traffic signalling systems) implies that ICT and sensors technology will have to become an integral part of the road construction. The function of the road at that point is not only *to provide mobility*, but is shifting toward providing services that are needed *for other systems to function*.

This is something that does not *at all* function in the way we build and maintain our roads today. For example: placing a sensor inside the top layer of the road may be what is needed for a particular technology to allow Car2Road communication. Based on its own laboratory tests, the manufacturer of the sensors may guarantee a functional life time of the technology of 10-20 years. Yet, implemented today, that technology is going to have a service life span of *maximum* one year, because that is how long it would take for cracks to start generating around the sensors, water to start collecting, pothole formation to occur and the sensor to no longer perform its function.

Perhaps the company that designed the sensor was in close contact to the road contractor and thought about this issue. Perhaps he made sure that the sensor was embedded in a layer of visco-elastic polymer, to make sure that the stiffness change due to the foreign material in the structure would not lead to premature cracks. Then, the sensor would *at best*, still only have a maximum lifetime of 5 years, because that is when the first maintenance cycle will be performed on the road and the sensors will either be removed when the top layer of the asphalt will be renewed or buried under a new layer of asphalt.

A shift in responsibility

What if the electrical vehicle developments start evolving further and the first large scale application of on-the-road-charging cars will become a reality? The loading patches of this technology would again have to be placed inside the pavement. What will happen if the system fails? And who will be responsible? If the charging technology is placed in the structural layers, the contractor that was in charge of that layer would traditionally be responsible. This actor may argue that it was not his material that caused the failure, it was the ICT company that developed the charging technology. So who will be financially and legally responsible for breaking open the entire road construction, block traffic, fix the technology breakdown and repair the road? Between the different contractors that where involved, the material suppliers, the ICT company and the road authorities,



this will proof to be a complex situation...And this is only one example to illustrate the importance of taking into account the entire system in product, social and institutional dimensions. Similar points can also be made for many other innovations that are currently being developed *related* to the road, but not *including* the road (e.g. truck platooning: it may save fuel for the vehicles but does it not cost more energy when thinking of energy spent for road damage repair due to increased loads?)

New technology is a system in itself, often optimized to function under different conditions than it will be confronted with in real life. Implementing it in the infrastructure sector in a successful manner implies treating it as a system of systems and relies on a proper awareness of the long term technical, social and institutional challenges.

A green materials focus

Traditionally based on minimizing risks, the infrastructure sector has never been keen on new technology. So, with the future functionalities on the doorstep, this is the time to ensure that this sector will modernize, embrace and drive innovations in its sector. If not, innovation will be pushed by 'outside' stakeholders that do not have the experience and insights of this sector and this can only lead to a waste of resources, a non-optimal situation and a society that is running behind the facts.

Why is this strategic innovation agenda then called *green infrastructure material innovations*, and not 'designing our future infrastructure'? One important reason for this is that most solutions of future functionalities, emission and energy usage reductions are in fact directly linked to the material value chain of this sector. Transport infrastructure's technical functionality, be it asphalt or concrete highways, rural gravel roads or railway structures, is all about materials. In contrast to housing, road structures have relatively simple mechanical designs. The complexity of roads lies in its interplay of materials and its interaction with the environment. So this is exactly where the innovation will also come from: New environmentally friendly materials.... New ways of producing, handling and maintaining the materials... Optimising the transport of the materials... Having performance based standards that allow for innovative materials...Ensuring that the construction methods allow for the new materials...Developing materials that enable new technologies to function inside the roads...Giving tools to contractors and transport authorities to handle greener roads...and all the spin-off technologies that will come from these innovations.

The GIMI tipping point

GIMI's focus also allows all the stakeholders to see the direct implications for their daily practise and, with its integrated approach, ensures that innovations are both top-down and bottom-up accepted.

By addressing the handling of risks with the contractors at management level, ensuring asset values with transport authorities, designing innovation based standards with standard-setting bodies and detailing the socio-technical implementation in *collaboration* with operational staff, GIMI will innovate the sector from the inside out.

But how can we make the giant leap towards innovating this sector from the inside out? How will GIMI enable this tipping point? The Swedish expertise, the annual investments, the willingness of the stakeholders and the advances of many technologies in other fields will be used as the starting point in GIMI. In GIMI, the technology developments will go hand-in-hand with education. Product, social and institutional spaces will be designed in parallel and have all the stakeholders involved. In using this *systemic approach*, GIMI will bring the academic inventions to practical innovations (and visa versa) and as such start enable the innovation to diffuse into all aspects of the sector.

Having established a national tipping point in the approach and structure of the infrastructure sector, the Swedish stakeholders are exceptionally well positioned to market themselves and their products on the global market. GIMI's *international approach* will ensure global dissemination and partnerships and lead to GIMInnovations becoming an important export product for the Swedish industry.

'GIMI will innovate from board-room to *construction site* fika-room'

What *is* the GIMI Agenda ?

(...and why should you want to become a part of it?)

GIMI *is...*

…a mindset change in an industry that is crucial for our society

…promoting that the production, handling, transportation, maintenance and functionality of Materials in the Infrastructure sector are as Green as possible

…enabling the industry to embed GIMInnovations in their daily practice at acceptable risk and maximum gain

…about cross fertilization of ideas, people and fields to enhance the momentum in the development of sustainable transportation infrastructure

…placing Sweden at the forefront of innovations in green materials, green infrastructure and a sustainable society

Bringing partners together

GIMI Open Platform | GIMI COOP program | Annual GIMI AIMday | GIMI research projects | GIMI online courses | GIMI Workshops | GIMI Newsfeeds| GIMI Innovations

High tech materials | ICT solutions | Vehicle and infrastructure developments | Advanced test equipment | Advanced material science knowledge | Embed GIMI questions in research

Making use of advances

Creating technically sound inventions

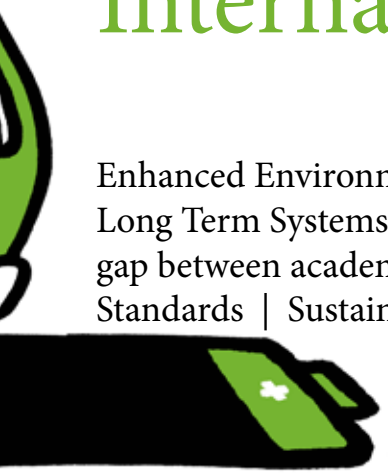
New road design procedures | Advanced material characterization protocols | Tools for Life Cycle optimization | Innovative green materials | Exploiting energy harvesting concepts | Greening the road supply chain effort | Optimised maintenance actions | Merge academia with industry | Provide GIMI APPs | Improved Guidelines | New GIMI design software

Provide on-line courses | GIMI Coop exchange program | Support industrial application | Support employment policies | performance based standards setting | Provide strategy vision papers | Design PS Training for knowledge transfer in operations | Developing board-room-to-lunch-room tools

Anchored in practise

Internationally active

Global partner network | Supported by the GIMI global network | Advising the European Union | Leading the Standardization Committees | Frequently asked GIMI experts | Widely visible in media | employing social media | presenting on the international innovation scene



Enhanced Environmental Consciousness in the Infrastructure Sector | Implemented Long Term Systems perspective | Interactive Knowledge Based Society | Closing the gap between academia and engineering practise | Improved Performance Based Standards | Sustainable spin-offs | Raising a new generation of engineers

Contributing to a Sustainable Society

The power of: an adjective & asking the *right questions*

Having the GREEN label on this national strategic innovation agenda is more than a 'buzz word': It is purposely chosen to steer the innovation direction very clearly towards sustainability. It is an adjective that empowers the individual stakeholder to stick out his/her neck and try something new. It gives the transport authorities clear guidelines for their policies and it focuses academia to be thinking in a systems perfective and to find answers to the right questions. The importance of asking the right question can be illustrated by this small classical joke:

'Two men are walking in the woods. A ferocious grizzly bear charges at them and they start to run. While running they shout:
Man 1:
Do you think we will be able to outrun the bear?
Man 2:
I don't have to.
My only question is 'can I outrun you?' '
Man 2 has identified the right question.

Making this agenda focus on *green,* forces everybody involved to be asking the right questions: 'are we handling our daily business in a green way, from an overarching system point of view'. The trick in this case is to allow the individual stakeholder to see beyond his/her own system and own boundaries and allowing him/her to see how each individual's contribution affects the entire system.

It thus takes an overarching agenda to ensure that individual stakeholders indeed get to this point in their *own* thought process and also understand their *own benefit* in doing so. The 'what's in it for me' is a question that is underlying all business ventures. The infrastructure sector is no different in this respect. It is in fact a healthy driving force for ventures to progress and evolve their businesses.

The difference in this sector, however, lies in the collective momentum that can be created when the individual stakeholders combine their strengths, while at the same time benefitting individually from doing so. This is where the first two parts of the knowledge triangle become important: *research* to pioneer and develop the novel concepts and *education* to create understanding on how to utilize this invention in practise. *Innovation*, however is the 3rd part of the triangle and will not happen unless research and education are fitted within the systemic perspective of the sector.

Part 1: GIMI Research

Innovation driven research is based on fundamentally sound basic research with a specific focus on its application. It also often takes multiple disciplines to successfully complete such projects. In the GIMI RESEARCH PROGRAM research clusters will be developed around specific topics to maximize the impact. For this, stakeholders will have the opportunity to be involved in various ways. They could be driving the project, be at the table during the strategic discussion or stand on the side line providing continuous feedback until the implementation stage is reached. All roles are valuable and all are needed. This leaves a lot of space for 'major' and 'small' players, and creates a playful environment that stimulates creativity in many respects.
To reach these potential partners the GIMI OPEN PLATFORM will be utilized. The purpose of any strategical research and innovation agenda is to create focus, drive momentum, develop new ways of bringing partners together and then allowing the creativity of the market to gradually start taking over.

Keeping in mind Edison's lightbulb: the research coordinated from GIMI is all strategic, inclusive and impact driven. To dissolve knowledge ownership issues, GIMI will develop a transparent policy towards the intellectual property protocol for all its research projects.

Part 2: GIMI Education

No knowledge transfer without education! In the GIMI ONLINE COURSE PROGRAM, courses will be developed that can be accessed by its 'students' via the GIMI OPEN PLATFORM from where ever they are sitting. In addition to courses, education also comes from awareness of other perspectives. GIMI AIM Days will be organized and a GIMI COOP PROGRAM will be established. In this program, staff and students from industry, academia, authorities or associated stakeholders can apply for a scholarship to spend 3-6 months at another facility.
Because operational people are not always able to leave an empty seat for long, their home company will receive another person in his/her place in exchange. As such, stronger ties between the stakeholders will be formed, a wider understanding of each other's daily realities is created and the system's perspective needed for the innovations will be achieved.
Besides developing targeted courses for enhanced

knowledge and exchange of personnel for enhanced insight into the system's perspective, another form of education will be needed. Namely, to learn and *educate ourselves* about how best to achieve the implementation of a particular innovation into practise.

Making a change in an industry as complex as the infrastructure sector, inherently means that not all bottlenecks can be overseen beforehand. So to avoid system failures, GIMI Participatory Simulation (PS) Training will be given in which, in a simulated environment, all the actors will be placed together to optimize the knowledge transfer and expose bottlenecks. Aspects such as *the human component* and *culture* will emerge from the PS training and will give specific insights on how best to implement the innovation in practise.

It's all about Part 3: GIMInnovation!

To enable GIMInovations to become a reality, the stakeholders must be collaborating together with a shared vision. Scientists to drive the knowledge, industry to apply the new technology, standard setting bodies to provide the supporting standards and policies and a strong (inter)national network to allow for dissemination, communication and cross-disciplinary interactions. Since GIMI is an ambitious agenda with many stakeholders, it is important that the environment is shaped in such a way that specific measurable in- and outputs can be defined.

For this reason the Agenda is divided into *11 Strategic Sub-Environments* that are described in more detail in the following.

'The GIMI environment is bringing the *knowledge triangle* into operation'

GIMI Strategic Sub-Environment 1:

The GIMI Open Platform

GIMI is about lifting the knowledge base of the transport infrastructure sector, advancing its green innovations, connecting people to each other to stimulate disciplinary cross-pollination and developing an international market for the Swedish innovations. To be able to do this, it is necessary to be able to reach all the relevant stakeholders located throughout Sweden. Furthermore, an important part of the transportation infrastructure sector consists of SMEs. Often originating from family owned businesses, GIMI is aiming at connecting these SMEs to each other, to larger (multi-national) industries and to academic partners to speed up the national knowledge base. Because operational people do not always have time nor feel comfortable to spent extended periods of time in academic institutions, GIMI is developing online courses on topics relevant for many different stakeholders in the environment (see also SSE-5). GIMI is about education, research and innovations. This means that results will be coming out of the GIMI projects which will directly be available to the GIMI partners in that project. But the results may also be relevant for other stakeholders, not directly involved. For all these reasons this SSE is focussing on developing the GIMI Open Platform. A web-based forum in which the latest research advances coming from the GIMI sub-environments can be found. This can, for instance, be in the form of articles, open function software, GIMI Apps or developed databases. The Open Platform will also be used as the vehicle for the GIMI on-line courses, so GIMI members have a one-stop-shop to find out which courses are available and planned within the GIMI environment or propose ideas for courses they would be interested in.

On the GIMI Open Platform members will also be able to find the partners and expertise available within GIMI, thus easily connecting to relevant people. The Open Platform will also serve as a Q&A forum, in which questions can be asked and answers will be given by the relevant expert(s) and also reaches the international GIMI partners, that are on different time-zones. The Open Platform is a dynamic environment on which members don't just go *to get* things but also *to give* things. Since the Platform is based on open standards and allows for cross platform interactions, members will be sharing their own tools and advances related to the GIMI vision. The Open Platform will also be utilized as a venue in which research and implementation ideas from all members can be posted. A structure will be developed within this SSE to allow for any member to participate in new research projects, develop a new project or GIMI initiative and be able to generate support from within the GIMI environment to bring the project into realization. Membership to GIMI is open to all, but requires a fee that has to be contributed to a selected GIMI activity. As such, the new member is automatically integrated into the GIMI activities.

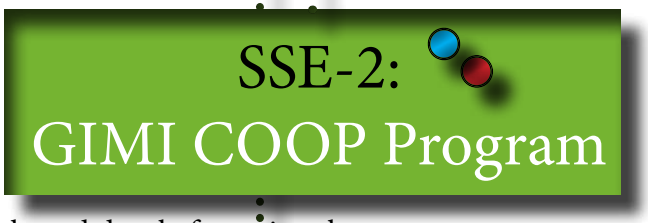
The GIMI Open Platform will serve as the face of GIMI to the outside works and reach those that are near and dear as well as those that are new and (geographically) far, but equally crucial to the Green Infrastructure Material Innovation vision.

GIMI Strategic Sub-Environment 2:

The GIMI COOP Program

Since knowledge transfer is an important function of the GIMI environment, a cooperative (COOP) program is developed in this SSE. The GIMI COOP Program will be connecting partners to each other to temporarily exchange staff. This can, for instance, entail:
- a B.Sc, M.Sc., PhD, or Exec.Edu student spending 3-6 months at one of the GIMI members' facilities to learn about their activities as part of the GIMI environment (e.g. governance, material production, infrastructure maintenance)
- an operational person from a GIMI Industry spending time at a research institute to contribute in a research project without the burden of his/her daily tasks;
- a partner spending time abroad with one of the international GIMI members to learn about an international green infrastructure material innovation perspective or develop expertise on an international technology.

In the COOP program, different tracks will be defined that can be selected from, when applying for a GIMI scholarship. One of the envisioned tracks is an *exchange* track, especially developed for SMEs and operational staff from industries that are normally not able to leave an empty seat for long at their home institution. In this, the exchange means effectively that another person that is also participating in the COOP program will fill this person's seat. Though these people will most often have very different qualifications from each other, a deepened relationship will be developed between the institutes which can lead to enhanced understanding and long-term knowledge transfer. In the case of students and young engineers participating in this exchange track, it also entails the training of these people within the companies and thus creating potential GIMI recruits for the future. The activities of the people participating in the GIMI COOP program can be diverse: from becoming part of an existing GIMI research project, to learning a new GIMI tool or technology, from joining GIMI research teams in ongoing engineering projects to spending time developing collaborative GIMI proposals.



All activities, small and large, long and short, will contribute to eventually having a larger *GIMI footprint* in the sector and will allow the environment to build up a critical mass of expertise. The GIMI COOP program, as such, is a crucial part of the GIMI program that aims at investing on the human capital within the environment and actively and deeply focussing the momentum and dynamics of the GIMI agenda.

GIMI Strategic Sub-Environment 3:

The GIMI Academy-Industry days

*...a question, one hour, a group of experts...*The concept of the Academy-Industry Meeting days, developed at Uppsala university, is focussing on providing creative solutions for industry and playfully connecting partners to each other. The entrance fee for a GIMI partners to be part of such a GIMI AIM Day is to bring a problem which they are actually confronted with in their engineering practise. This problem has been sent in advance and the SSE-3 has invited a group of experts to study the problem. On the Meeting Day, the expert team then spends an hour treating the problem, giving a solution to the GIMI partner and bringing them into contact with people from the GIMI environment that could contribute to the solution. By participating in the GIMI AIM Days, GIMI partners not only receive realistic and innovative ideas for their problems that include current state-of-the-art knowledge, they also get to develop new collaborations which can serve as inspirations for expanding their green infrastructure material innovations activities within their institutions and companies.

In addition to organizing the academy-industry meetings according to the original AIM day concept in collaboration with the original developers, SSE-3 will develop a more expansive strategy towards organising academy-industry meeting days throughout the year. As such, this environment will work from various angles to ensure that there is a structured, yet creative, atmosphere for the academic and non-academic partners to discuss and brainstorm about potential solutions for ongoing project in line with the GIMI vision. In addition to developing potentially innovative solutions, starting new research oriented projects within the GIMI environment (see SSE-4), and closing the gap between industry and academy, there is also another advantage: Namely, through this SSE, GIMI is actively monitoring how the industries in the transport infrastructure sector are developing, what are their main concerns and how are GIMInnovations slowly diffusing throughout the country...

GIMI Strategic Sub-Environment 4:

The GIMI research program

SSE-4:
GIMI Research Program

In GIMI, research is an important driving force to develop deepened understanding, cross-disciplinary solutions and long-term relationships between the GIMI scientists and the GIMI stakeholders. It is of utmost importance, however, to ensure that the GIMI environment is not merely a source for funding separate research projects that individually will not create sufficient impact on the sector. Rather, a structured program in which research projects are coupled to each other in a way that a collective momentum can be developed is needed. For this reason the SSE-4 environments will develop a GIMI research program in which research *clusters* will be defined and nurtured. A GIMI research cluster could, for instance, consist of 3 larger or 30 smaller research projects, that are essentially connected to each other, are aware of each others activities and share vision, resources and ideas on a regular basis. *Ideas* for such research projects can originate from many sources in the GIMI environment, for example: suggested research projects from new members on the GIMI Open Platform, suggested ideas from any of the GIMI stakeholders, originating from a GIMI COOP collaboration or following a GIMI AIM day session.

This SSE has therefor an important task to:

- actively invite research ideas from the environment;
- collect all research ideas;
- evaluate them for their GIMI vision;
- ensure that all the necessary stakeholders are involved;
- help develop a GIMI funding strategy.

SSE-4 will also check if the milestones are being reached on time and ensure that clusters with appropriate size and focus are created. In the GIMI Road Map, a gradual increase of the annually starting new GIMI research clusters is anticipated (from 2-4 clusters starting in 2014 to 8-10 in 2016 - see GIMI Road Map).

The results that come from these clusters should be disseminated in and outside the GIMI environment (with support of the GIMI Communication and Dissemination Sub-Environments, SSE-0 and SSE-10), may come with a need for education to train and explain (with support of the GIMI Online Course Program in SSE-5), must be brought into a system's perspective by training the operational staff that would be working with the GIMInnovation (through the Participatory Simulation Training in SSE-8), may lead to large scale demonstrations (through SSE-9) and may need an exploitation strategy beyond Sweden (through the Strategic Partnerships and Exploitation Sub-Environments, SSE-8 and SSE-10).

So SSE-4 is an important environment in the GIMI agenda that ensures targeted research projects with multiple stakeholders and utilizes and connects all the other GIMI sub-environments to bring the innovations to successful implementation.

GIMI Strategic Sub-Environment 5:

GIMI Online Course Program

Education being a crucial part of the knowledge triangle, this SSE will be in charge of developing the GIMI Online Course program. Since innovation cannot be done without sufficient 'explaining and training' associated with new technologies, processes or principles, SSE-5 has an important role in reaching the aims of the GIMI agenda. Through the GIMI Open Platform (see SSE-1) a dynamic course program will be offered to the GIMI members. These courses could be aimed at the (middle) management level of the infrastructure sector, on the operational staff, the R&D layers or on (B.Sc., M.Sc., PhD or Exec.Edu) students. The content and form in which the GIMI courses will be offered will be catered towards the intended audiences. It is therefore envisioned that large parts of most courses will be offered 'on-line'. Meaning that participants can follow the lectures and do the exercises at times that suit their personal schedule. Since community building and peer-mentoring are also important facets of following a course, actual and virtual class-room time with live interactions between the participants and with the teachers will always be part of all the GIMI courses.

In addition to reaching the various stakeholders, the international partners will also become an important user segment of the GIMI Online Course Program. For this reason, attention will also be paid to *cultural* and *language* aspects in the courses. Additional modules to provide language assistance and close interactions with local teachers to ensure the effectiveness and appropriateness of the content and form will be included when needed.

The course ideas can come from many sources within the GIMI environment, for instance from the researchers in the research clusters in SSE-4, from the inter(national) participants within the GIMI environment or from 'outside' sources that turn to GIMI for their expertise on GIMInnovations. The teachers of the courses will be selected from within the GIMI environment. By doing so, SSE-5 will build up a steady pool of 'innovation teachers' that are willing and able to explain and teach about GIMInnovations or GIMI related topics. Since it can be envisioned that there is a large interest from some of the operational staff or industry members to also teach some modules within these courses, SSE-5 will also develop 'train-the-teacher' courses to lift the collective ability of the GIMI environment to educate and teach.

In addition to developing new courses, the GIMI Online Course Program will also gather and spread information about existing (online) courses that may be of interest to the GIMI community. After completing a course from the GIMI course program, participants will receive a GIMI certification stating that they have successfully followed and completed (via an examination) a GIMI course.

SSE-5:
GIMI Online Course Program

GIMI Strategic Sub-Environment 6:

GIMI standardization

Considering that innovations in the transport infrastructure sector need standardization, an important means to facilitate the introduction of new products on the markets is to have them covered by standards. The process towards developing the standards, in other words the *standardization* process, is traditionally a procedure in which it is very important to have as many stakeholders involved from as early a stage as possible. If not, standards may be developed on the national or international scale that are not conducive to the innovation potential of the sector.

For this reason SSE-6 will analyse the market demands in this respect and assist in initiating required standardization work on the national (SIS), the European (CEN) and the global level (ISO). This Sub-Environment will also connect closely to the research clusters in SSE-4 to ensure that, by the time the GIMI research results evolves into stages of implementation, the appropriate standardization has been developed in parallel and the standards developed will support the GIMInnovations coming to the market. An important development in the GIMI environment that SSE-6 will lead is the change towards performance based standards. Instead of specifying 'the recipe', standards should be specifying the function. By doing so, standards will be much more supportive of and stimulating for innovations on the market. For example, CE marking did exactly that: many European countries (for instance in the Netherlands) saw a change on the market when CE marking was introduced, in which SMEs became frontrunners of innovations, because that is where they could create their competitive niche on the market. Additionally, SSE-6 will work closely with SSE-7 to also include a systemic approach, in which not only the product space is described in standards (via technical specifications) but also care is taken for the institutional and social spaces associated with the technology. SSE-6 will thus play an important role in actively working with all the necessary stakeholders to move in this direction to make the market GIMInnovation ready.

Considering the globalization of our current and future society, standardization has very much become an international matter. It is therefore very important that GIMI has an active participation in all the relevant international standardization committees. As such, GIMI can be a leading voice and ensure that the direction taken in Europe and beyond is in line with the GIMI vision. This GIMI Sub-Environment is therefore very important for the GIMI agenda and closely links to SSE-4 (GIMI Research Program), SSE-9 (GIMI Demonstrations) and SSE-10 (GIMI Dissemination and Exploitation). Since education regarding the use of new standards and understanding of the changes from a system's perspective with respect to the old standards are also very important, SSE-6 will also closely collaborate with the education and training focussed GIMI Sub-Environments (i.e. SSE-5 and SSE-7 on GIMI Online Course Program and GIMI Participatory Simulation Training, respectively). As such, this Sub-Environment plays an important link between many of the other GIMI SSEs and plays a crucial role in reaching the aims of the GIMI Agenda.

GIMI Strategic Sub-Environment 7:

The GIMI Participatory Simulation Training

Since the GIMI vision aims at revolutionizing the infrastructure sector's sustainability, the actual usage of any innovation that comes from the GIMI environment is key. Implementation of innovations are, however, not *at all* an easy challenge to tackle. In most industries this is somewhat the case, but the infrastructure sector posses and *exceptional* challenge with this respect. Being a complex socio-technical system, changes in technology or methods imply new structures for 'doing business' that affect more components of the sector than technically required. Most innovations, brought to this market on their own, with only technical specification will therefore not lead to successful implementation. Instead, in addition to focussing on technical aspects in the *product* space, new technologies should also come with an integrated approach for alignment of the change in the *institutional* and *social* space. For this reason SSE-7 is an important Sub-Environment in the GIMI Agenda.

Treating the infrastructure sector as a complex socio-technical system in which the institutional, social and product space are all addressed, SSE-7 will develop GIMI Participatory Simulation Training sessions. In these, all the (operational) stakeholders that are affected by, and will have to deal with, the new GIMInnovation are brought together in a simulated environment. In this environment, an artificial but realistic enough simulation of the actual system will be made, in which the technology change is brought into a system in which all the actors have a role to fulfil. By analysing what happens during the simulations, unforeseen bottlenecks that have to do with peripheral technology, human behaviour and unspoken cultural aspects, will become clear. As such, the PS Training sessions will lead to *detailed information* on what other aspects in the system have to be altered or taking into consideration when bringing the GIMInnovation to the market. In working closely with SSE-6, a new generation of system performance based standards can be developed, in which not only the technical aspects of the specific technology are described, but also the socio-technical system aspect.

By bringing different stakeholders together, showing each other the complexity of their own daily choices and being confronted with the effects each individual has on the collective system, SSE-7 will also have a high educational value for the GIMI Environment. SSE-7 will develop the PS sessions in such a way that the sector gradually will be able to perform the sessions themselves. Since this may also involve preparing and training operational people to lead such sessions, SSE-7 will work in close collaboration with SSE-5 to develop 'train-the-trainer' courses. So in the future, members from within the GIMI environment can pre-test their GIMInnovations in a simulated environment before trying it out in the field. As such, the entire sector may change its resistance towards 'unknown' technologies, start having a routine via which they can test innovations to minimize risk, and thus start innovating from the insight out.

PS. Will help support the implementation of the GIMI agenda by training the industry for knowledge transfer...

GIMI Strategic Sub-Environment 8:

GIMI strategic partnerships

In the GIMI agenda, collaboration between the important stakeholders is a red thread through all the activities in the environment. Even though the overall vision of GIMI is very focused and will stay the same over the years, depending on the stages of the environment's development, different partnerships may be needed. For instance, in the beginning of the GIMI Agenda the partnerships needed in the environment are those that have the capacity, resources and shared vision to contribute in starting up all the GIMI activities in the Sub-Environments. For this reason, first focus is placed on having larger *entrepreneurial* industries, *governmental* bodies and active researchers on-board of the GIMI agenda. After the start-up phase, the infrastructure within the GIMI environment is such that strategic partnerships can be extended to included *niche* industries, *SMEs* or other *smaller* companies that then, through this infrastructure, have the ability to actively participate (e.g the GIMI Open Platform or the GIMI Online Course Program). At a further stage, for instance when the research clusters in the GIMI environment start developing products, it could be that strategic partnerships are needed in specific (foreign) markets or that large scale demonstration sites need to found. So again, another additional pool of partners may be recruited inside the environment.

To optimise the development of the GIMI agenda and to shorten the implementation times, SSE-8 is in charge of monitoring the needs from within the GIMI Environment in terms of strategic partnerships. This Sub-Environment will then be developing activities to establish the necessary strategic partnerships. The identification of which people and which companies are seen as 'strategic' for the GIMI agenda will be done by SSE-8 in close collaboration between most other GIMI SSEs. Since, as GIMI evolves, a healthy balance between new project clusters starting, some projects being mid-way and others at the final stages of implementation, a particularly close collaboration with SSE-4 (GIMI Research Program) is anticipated to ensure timely actions from the SSE-8.

So SSE-8 is a sub-environment that will have activities that are very much in parallel with the other SSEs. As such it will be a flexible and dynamic environment that is well connected within the national and international sector in- and outside GIMI. Members of SSE-8 are thus also those that are involved with many 'network' activities, such as Swedish Branch organizations and international clusters and committees (e.g. FEHRL, RILEM or Cost actions). As such, SSE-8 will also be able to disseminate the GIMI activities to a wider audience about GIMI activities as well as recruit new members. For these activities SSE-8 will work closely with SSE-10 (GIMI Dissemination & Exploitation). Since Sweden will also develop other Strategic Research & Innovation Agenda's over time, SSE-8 will monitor which are relevant for GIMI and should be connected to its environment. SSE-8 can therefor be seen as an important blood-vessel within the GIMI environment, that is constantly refreshing the supply and ensures enough oxygen is provided.

GIMI Strategic Sub-Environment 9:

GIMI demonstrations

Traditionally the infrastructure sector works with 'proven concepts' which means that (large scale) demonstrations are an important part for any new material, technology or system before being transferred into 'real life'. Considering that a large part of GIMI will be related to the integration of different technologies and concepts (e.g. ICT & infrastructure, energy harvesting from the infrastructure, vehicle-road interaction and complex material interactions) it is not merely the infrastructure side that needs to be tested. The interaction of the infrastructure with its environment, including new components, new vehicles or new circumstances entails a need for testing the entire system. SSE-9 will work closely with the GIMI Research Program to identify the projects within the GIMI environment in which a technology needs to be tested via large scale demonstrations. Since demonstrations often bring high costs and long-term committed evaluation with them, this Sub-Environment has the important task to keep an overall view of the activities within the GIMI Environment to optimise the demo selections.

Making use of the strategic alliances formed in SSE-8 and working closely with the National and International Reference Groups, SSE-9 will develop a GIMI database of planned and executed (inter)national venues of small and large scale demonstrations that can be of use by the members of the GIMI environment. Often in large scale demonstrations, only the technical aspects are under evaluation. Since this is addressing only the the product space, SSE-9 will work with SSE-7 (GIMI PS Training) to ensure that the social and institutional spaces are also considered when developing the demonstrations. As such, the quality of the demonstrations will be significantly improved and the speed of successful transfer to practise enlarged.

Since smaller sized partners in the GIMI environment (e.g. SMEs) are normally not able to afford (cost-wise or capacity-wise) development of their own large scale demonstrations, SSE-9 will develop opportunistic partnerships within the GIMI environment. As such, all GIMI members will have the opportunity to participate in such demonstrations under acceptable conditions for each. As such, the entire GIMI community potential will get lifted as 'smaller' entrepreneurs will find themselves in a more creative environment, open for innovation, shared opportunities and shared risks and larger partners develop dynamic collaborations driven by the aim to innovate.

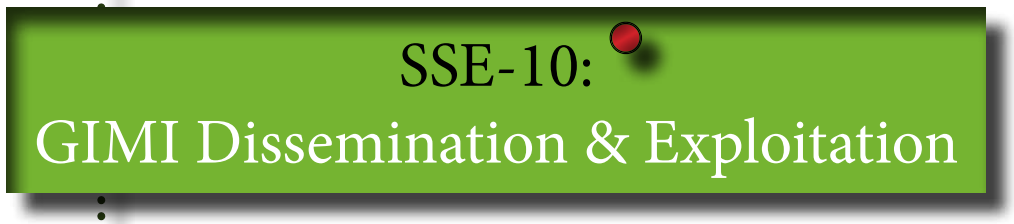
GIMI Strategic Sub-Environment 10:

GIMI dissemination & exploitation

Focussing on bringing GIMI innovation to the market, it is important to have a solid plan for dissemination and exploitation of results. Bringing the GIMI products to the market, can mean that investments have to be made in local or foreign markets and strategic alliances may also be necessary with local vendors or training of staff at companies that want to adopt the GIMI technology. All the aspects related to the consorted effort of dissemination and exploitation will be taken care of in this GIMI sub-environment. For the training aspects SSE-10 will work closely with the education and knowledge transfer GIMI environments (GIMI Online Course Program and GIMI Participatory Simulation Training, SSE-5 and SSE-7 respectively).

SSE-10 is actively coordinating the legal and financial aspects of knowledge transfer to the market using the GIMI 'open innovation' policy. This approach towards IP issues assumes that industry can and should use external ideas as well as internal ideas, and internal and external paths to market, as the industry look to advance their technology. This open innovation policy is relevant, for instance, for knowledge asset substantiated by a licensing agreement (patents, copyright) or service contracts (licensing, sales or consultancy). Considering that most products will come directly from the GIMI research clusters, multiple partners will also be involved, GIMI's open innovation policy will allow for a clear and transparent approach regarding exploitation issues and will be coordinated by SSE-10.

SSE-10 will also be keeping track of the Total Addressable Market (TAM) values of the products and services created in the GIMI environment and continuously explore exploitation opportunities. As such this Sub-Environment will work closely with SSE-8 on strategic alliances and SSE-0 on communication.



Why does Sweden want to focus on GIMI ?

(...and become a world leader in this field?)

Made in Sweden

A large part of the transport infrastructure today is still made from aggregates, bitumen and cement. The embedded energy in these materials is high and can be lowered by new designs and innovative materials. This embedded energy can also be capitalized on by introducing novel energy harvesting concepts as part of the green materials design.

Designing materials to be green also means to reduce the supply chain effort that is associated with their production and, as such, reduce transportation distances, energy waste and emissions. For such innovations to become reality, a consorted effort is needed in which all relevant stakeholders are at the same table, pointing their noses in the same direction, having a focused GIMI agenda.

Looking at the infrastructure sector in Sweden today, the amount of material that is produced and transported each year is tremendous: With well over 2300 aggregate quarries spread around Sweden, 80 Mtonnes of aggregates are produced annually, of which more than half goes directly into infrastructure applications. Added to these the 10 Mtonnes of aggregates coming from civil engineering works, well over 50 Mtonnes of infrastructure aggregates are produced each year. Additionally, 10 Mtonnes of asphalt is produced in Sweden for which 500 000 ton bitumen is produced. All this amounts to a (conservative) 200 000 asphalt and 1.0 million aggregate truck loads being driven through Sweden each year.

Estimating that the average transport distance for an asphalt truck in Sweden is around 100 km, and for an aggregate truck around 50 km, amounts to a total of 70 *million* km travelled each year. Considering that this number still excludes many infra materials, such as portland cement concrete and additives, and assumes that the transport is optimized to not have any empty or half-filled trucks, transport is a significant factor in the supply chain of this sector.

Using a freight-emission calculator, transport of these material alone would lead to over 150 000 tons of CO_2 emissions. And this is only for the transport of the material. It does not yet address the emissions created and energy used during the production of the materials.

So with 90 *billion SEK* in annual expenses to build and maintain the national infrastructure network, and *1.2 million truck loads* being driven around to transport infrastructure material, the time has certainly come to do things differently in Sweden.

Becoming GREEN

Beside the societal need for more green infrastructure material innovations in the future, there is today much more advanced knowledge and test equipment available that can be used for research on infrastructure materials, making it possible to smartly modify them to optimise their lifetimes and reduce their environmental burden.

Greening the infrastructure sector can only be done, however, when academy, industry and government unite their focus and work together on a common agenda. GIMI is giving this opportunity to Sweden by bringing stakeholders, expertise and research and implementation infrastructure into one environment. In the GIMI environment a new generation of GIMInnovations will be developed, tested, applied and monitored in practise. In addition to the industry's willingness to take the leap in implementing GIMInnovations, GIMI is uniting in-depth material science and processing knowledge, insight into the

Why does Sweden want to focus on GIMI?

'Every year over 70 million km is travelled to *transport* infrastructure materials in Sweden'

‘Investing in Green and *infrastructure* is like ketchup and spaghetti: a perfect Swedish combination’

entire transport infrastructure sector (including supply chain efficiency and operations), know-how of Swedish and international standardization and regulation revisions and a true appreciation of the complex socio-technical structures on which the sector is built.

As such, GIMInnovations will become important export products that raise the Swedish competitiveness and GIMI members will act as *greening* ambassadors in society.

GIMI’s global contribution

Combining these knowledge areas is by no means a trivial task that can only be achieved by forming close collaboration between all the stakeholders in the GIMI environment. A global GIMI network of partners that support these innovations, both by contributing research and educational expertise as well as foreign market implementations will make the Swedish Transport Infrastructure sector immediately one of the major international frontrunners in sustainable innovations.

Following the EU’s vision in “Europe 2020” (COM (2010) 2020) on sustainable growth, the flagship initiative “A Resource Efficient Europe” (COM (2011) 21) and its “Road Map to A Resource Efficient Europe” (COM (2011) 571), the GIMI agenda is Sweden’s direct answer to contributing to a sustainable society for our future generations.

Presenting the GIMI Road Map!

(...leading the way from 2013 to 2030 and beyond)

GIMI Road Map Instructions

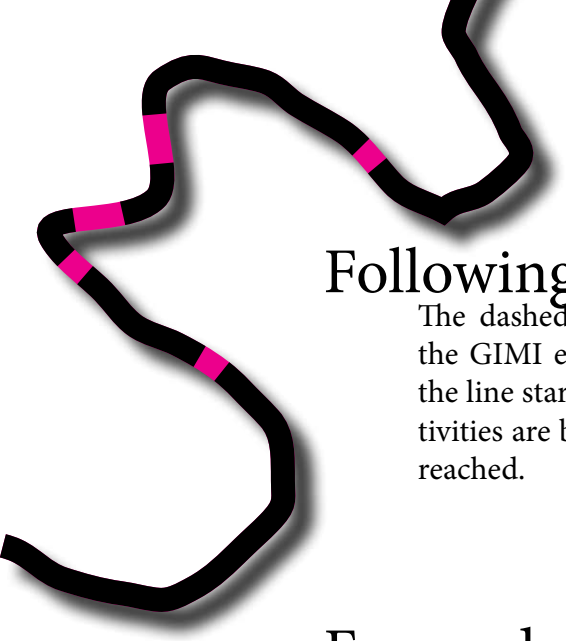
A National Strategic Research and Innovation Agenda involves multiple actors, various angles and different types of activities over a long time-frame. Considering GIMI is about bringing large scale *sustainability* to the Swedish society by transforming the role and structure of the transport infrastructure, it is of great importance to keep its focus, have an inclusive and transparent agenda, and continuously ensuring that the environment is still moving towards its goals. For this reason the GIMI Road Map is developed. Starting from 2012 in which Vinnova launched an open call for Sweden to develop a vision on its future, till the start-up activities in 2013 all the way till 2030 in which Sweden will have truly become world leading in Green Infrastructure Material Innovations: the GIMI Road Map defines many milestones, shows the GIMI activities along the way that are needed to get there, keeps a clear focus on its direction, yet includes many side-paths...

Since many stakeholders take part in the GIMI environment, the GIMI Road Map can be utilized in various ways. For partners that have a strong coordination and leadership role in the environment it can serve as a *comprehensive achievements guide* through the GIMI environment, with clear activities and milestones to be reached. For partners that take part in specific activities, it can also serve as a map to show *how various activities are integrated* with each other to reach the common GIMI milestones. Or, when a partner is active in another Strategic Innovation Agenda, but wants to take part in the GIMI environment for a specific common activity, it shows how one can take *another route with a different destination* that occasionally crosses the GIMI's main route. By temporarily sharing paths, it enables such a partner to share its direction and combine its expertise with the GIMI members.

Depending on the role and the background of the member in the GIMI Environment, the GIMI Road Map can have different functions. But at all times, it:

- keeps the focus of the Agenda;
- allows other roads to cross and join for a while;
- integrates all the activities in the environment;
- shows how much fun can be had, when being on the road to innovation!

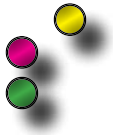
The GIMI Road Map is build up out of various components. To be able to follow the Map and use it as your own guideline through the GIMI environment: read the instructions and join us!



Following the path

The dashed line serves as a main guide through the GIMI environment. Initially with empty gaps, the line starts filling itself more and more while activities are being performed and milestones will be reached.

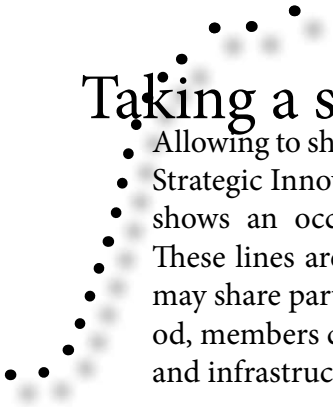
Focused activities



Many activities are planned along the road which are indicated by the colored dots. Different partners will be active in different activities. The activities can be focused on research, education or innovation. But often they integrate two or three of these.

Reaching Milestones

The important milestones in the GIMI agenda are indicated by the red flags. Generally at the end of a year, the milestones represent important achievements which have been collectively reached in the GIMI environment. Key Performance Indicators, based on the knowledge triangle will be used to measure whether the milestones have been successfully reached according to the Road Map.



Taking a sidetrack(*)

Allowing to share expertise and activities with other Strategic Innovation Agendas, the GIMI Road Map shows an occasional crossing with dotted lines. These lines are part of another strategic focus that may share part of the GIMI ideas. During this period, members can cross routes and share knowledge and infrastructure.

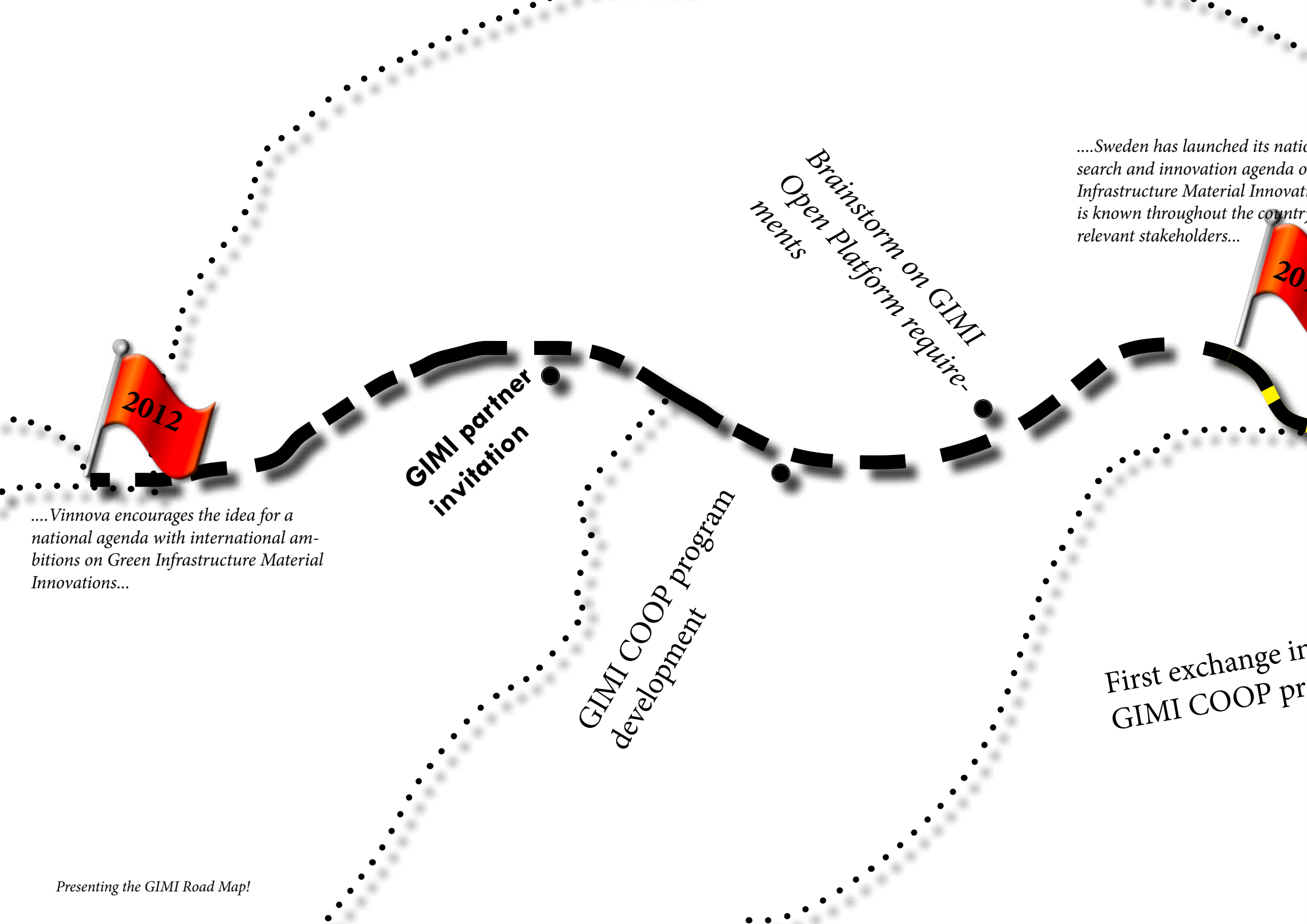
Changing colors

As the map evolves in time, the colour of the environment starts slowly changing towards a darker green. This is a measure of the achievements of the GIMI vision.

Enjoy the view!

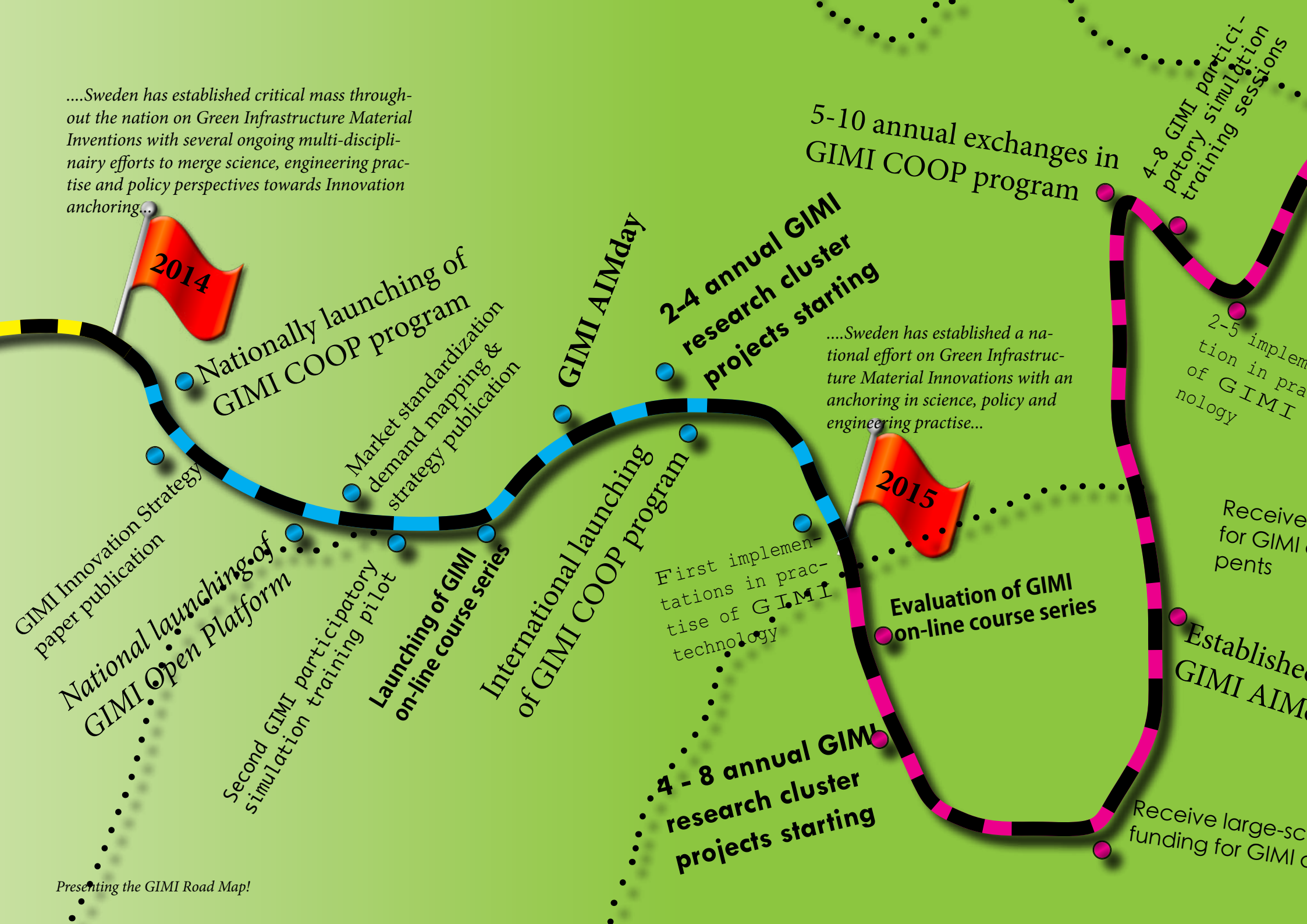
Even though the purpose of starting on the GIMI Road Map is to reach the described destination(s), the GIMI Road Map also points out that many enjoyable activities are part of the road towards the ultimate GIMI vision.

(*)The currently identified sidetracks are: (i)MinBas SIO, (ii)ICT-BIM SIO and (iii) Nationell Kraftsamling för Transportrelaterad verksamhet till år 2050 SIO, but more can be envisioned in the future...



Presenting the GIMI Road Map!


onal re-
n Green
ions and
y by the
13
GIMI partner commitments
ogram
Develop national and international funding strategies
Draft market standardization demand mapping
Draft GIMI Innovation Strategy paper
Beta version of GIMI Open Platform launched
First GIMI participatory simulation training pilot
GIMI AIMday
Receive Vinnova funding for GIMI agenda
Feedback and evaluation of GIMI COOP program
Evaluation of GIMI Open Platform
Start of first GIMI cluster research project
Launching of first GIMI on-line course
2014
GIMI Innovation Strategy paper publication
....Sweden has established critical mass throughout the nation on Green Infrastructure Material Inventions with several ongoing multi-disciplinary efforts to merge science, engineering practise and policy perspectives towards Innovation anchoring...


....Sweden has established critical mass throughout the nation on Green Infrastructure Material Inventions with several ongoing multi-disciplinary efforts to merge science, engineering practise and policy perspectives towards Innovation anchoring...
2014
Nationally launching of GIMI COOP program
Market standardization demand mapping & strategy publication
GIMI AIMday
2-4 annual GIMI research cluster projects starting
5-10 annual exchanges in GIMI COOP program
4-8 GIMI participatory simulation training sessions
2-5 implem
tion in pra
of GIMI
nology
....Sweden has established a national effort on Green Infrastructure Material Innovations with an anchoring in science, policy and engineering practise...
2015
GIMI Innovation Strategy paper publication
National launching of GIMI Open Platform
Second GIMI participatory simulation training pilot
Launching of GIMI on-line course series
International launching of GIMI COOP program
First implementations in practise of GIMI technology
Evaluation of GIMI on-line course series
Receive
for GIMI
pents
Established
GIMI AIM
4 - 8 annual GIMI research cluster projects starting
Receive large-sc
funding for GIMI
Presenting the GIMI Road Map!


International launching of GIMI Open Platform
Regularly provide advice for Swedish GIMI related standards setting
....Sweden is guiding the EU towards large scale implementation and anchoring of Green Infrastructure Material Innovations...
2020
15-20 GIMI participatory simulation training sessions
GIMI AIMday
8-10 annual GIMI research cluster projects starting
5-10 implementations in practise of GIMI technology
Popular GIMI on-line course series
Clear return of GIMI investments
....Sweden is now world leading on the invention, implementation and nurtering of Green Infrastructure Materials Innovations and sets the agenda for global developments...
2030
New generation of GIMI minded engineers
Regularly advice for European GIMI related standards setting
EU funding
annual
Industry
developments

Who are the GIMI visionaries?

(...and how will the agenda be managed ?)

Managing the GIMI agenda

The GIMI environment is organized and coordinated by the GIMI Management Team (MT). The GIMI MT will be in charge of the strategic developments and overall vision of the GIMI agenda, decides on who are the coordinators of the GIMI Sub-Environments, approves of new strategic memberships within the environment, is responsible for the GIMI budget and writes the GIMI's Annual Performance Report. The GIMI environment also has two reference groups: the GIMI National Reference Group (GIMI-NRG) and the GIMI International Reference Group (GIMI-IRG). These reference groups ensure that the GIMI environment is inclusive in its views, is aware of other national and international relevant activities, suggests new activities or strategic membership(s). They will also be in charge of reviewing GIMI's activities via the GIMI Annual Performance Report. The MT will (physically) meet twice a year with the GIMI-NRG and once with the GIMI-IRG. These groups will also be consulted throughout the year in case specific activities need to be evaluated or feedback is needed on MT decisions.

To make the GIMI agenda managable, the environment is split into 11 Strategic Sub-Environments (SSEs). Each of these SSEs has their own coordinator, SSE MT and membership base. Since the sub-environment all have very different scopes and characters, the SSEs MTs are in charge of their own management structure in terms of number of meetings and reporting frequency.

The GIMI MT consists of:
- The GIMI Coordinator
- The 10 GIMI Strategic-Sub Environment Coordinators (GIMI-SSEs)
- The Chair of the GIMI National Reference Group (GIMI-NRG)
- The Chair of the GIMI International Reference Group (GIMI-IRG)

The GIMI-NRG consists of:
- The GIMI-NRG Chair person
- A representative of the GIMI-IRG
- Invited members that include sufficient representation of all the national stakeholders

The GIMI-IRG consists of:
- The GIMI-IRG Chair person
- A representative of the GIMI-NRG
- Invited members that include sufficient representation of the international stakeholders

The GIMI-SSE MTs consist of:
- The SSE-Coordinator
- Key members from the specific Sub-Environment.

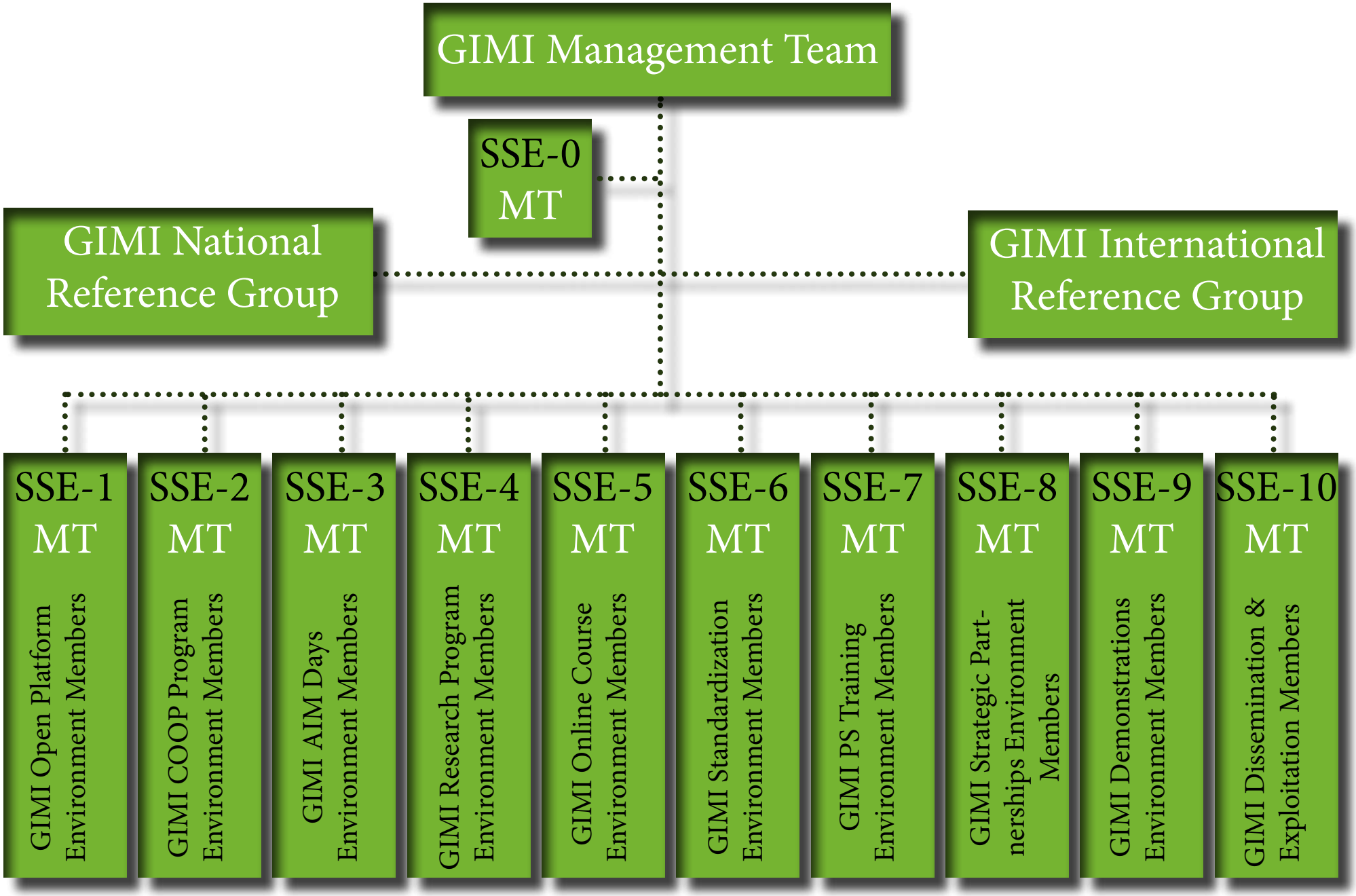


Figure 1: GIMI Environment Structure

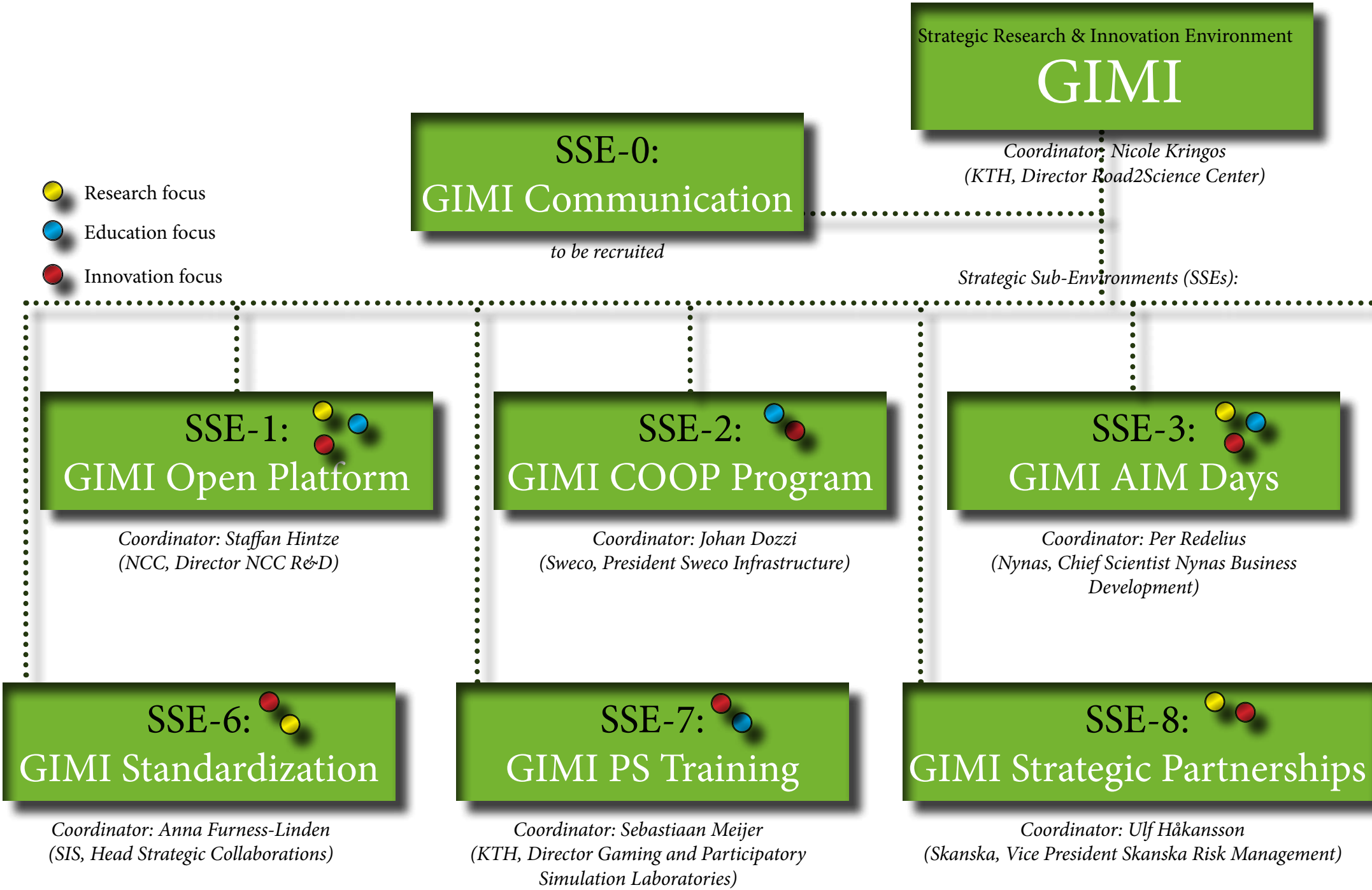
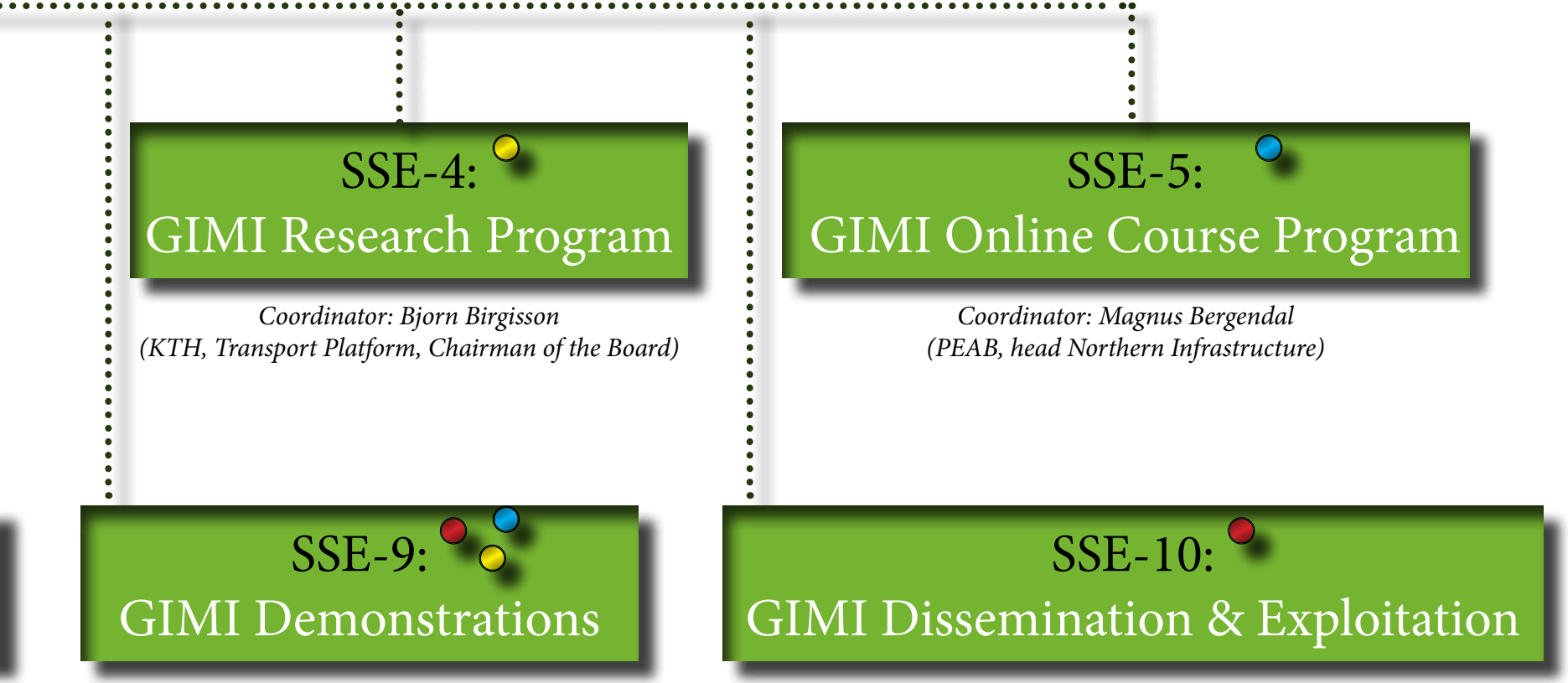


Figure 2: GIMI Strategic Sub-Environments Structure

GIMI Strategic Sub-Environments

Considering the high ambition of the GIMI agenda and the many stakeholders involved, the environment is divided into 11 Strategic Strategic Sub- Environments (SSEs). Each of the SSE Coordinators, selected for their acknowledged technical and managerial expertise and extensive experience also with respect to collaborative projects, will coordinate and integrate the work of the partners involved. The GIMI Coordinator will ensure that all SSEs are connected to each other and follow the GIMI vision. Though all SSEs contain elements of research, education and innovation, some have a larger focus on either of these or a combination thereof. This is indicated in Figure 2.



GIMI National Reference Group

The GIMI National Reference Group (GIMI-NRG) will serve as an important body within the GIMI Environment to give input regarding Swedish view points, policies and technological development from relevant stakeholders. In this role, the GIMI-NRG ensures that the GIMI environment is inclusive in its views, is aware of other national and international relevant activities and suggests new activities or strategic membership(s). In Table 1 an overview is given of the suggested organizations and representatives to take a seat in the GIMI NRG. Importantly, through the direct participation of Jan Bida from MinFo and Per Muren from NCC, Olle Samuelsson from IQ Samhällsbyggnad and Mikael Nybacka from the KTH Transport Platform, direct connections to other national strategic innovation agendas (MINBAS SIO, ICT-BIM SIO and "Nationell Kraftsamling för Transportrelaterad verksamhet till år 2050' Strategic Innovation Agenda, respectively) are developed. It is envisioned that, as the GIMI environment starts its activities, more members will be included in the GIMI NRG to represent additional stakeholders.

Though membership in the GIMI-NRG can change over time, it is in principle not subject to a standard rotation, as commitment to the environment is important in GIMI. As the Agenda evolves, however, more members could be added to have a sufficient knowledge base in the GIMI-NRG to reflect new ventures or developments.

The GIMI management team will meet twice a year (in Spring and Fall) with the GIMI-NRG to discuss the GIMI activities and developments. One of these meetings will include the GIMI International Reference Group. At the end of each year the Annual GIMI Performance Report will be send to all members of the GIMI-NRG for their comments, to be discussed in further detail during the Spring meeting. When organizing events (e.g. a GIMI Academy - Industry Meeting days or a GIMI Symposium) the members of the GIMI-NRG will be consulted for their input, for instance in suggesting speakers, themes to be discussed or additional events to be organized. The GIMI-NRG can also bring forward suggestions for GIMI large and small-scale demonstrations. In the case of a SSE Coordinator no longer being able to act as the coordinator of his/her SSE, the GIMI-NRG will be consulted for a possible replacement.

All members of the GIMI-NRG will act as ambassadors of the GIMI environment throughout their organization.

Table 1: Organizations involved in the GIMI National Reference Group

Stake-holder	Representative(*)	Organization
Government	Marie Wall	Vinnova
	Anna Ledin	Formas
	Anneli Eriksson	Energi Myndigheten
	Agneta Wargsjö	Trafikverket, Strategic Development
	Per Andersson	Trafikverket, Rail- and Road
	Susanne Toller	Trafikverket, Environment
	Curt Linder	SIS
Bran-chorg.	Jan Bida	MinFo
	Malin Löfsjögård	Svensk Betong
	Olle Samuelsson	IQ Samhällsbyggnad
Research	Per-Erik Petersson	SP, sveriges tekniska forskningsinstitut
	Robert Karlsson	VTI, BVFF coordinator
	Stellan Lundström	KTH, Real estate economics
	Ulf Karlsson	KTH, Materials Platform
	Mikael Nybacka	KTH, Transport Platform
	Peter Göransson	KTH, ECO2 Center
	Jonas Eliasson	KTH, CTS Center
	Fredrick Lekarp	InnoEnergy KIC
	Hans Lind	KTH, Procurement
	Karl Henrik Jansson	EIT ICT Labs KIC
Contractors & Materials	Per Muren	NCC Roads
	Magnus Alfredsson	NCC, Construction
	Roger Nilsson	Skanska, Infrastructure
	Nils Ryden	PEAB, Infrastructure
	Helene Odelius	Nynas, Nordic Regions
	Hanson Sverker	Sweco, Traffic consultant
	Daniel Hagberg	AkzoNobel

(*) *Subject to their organizations, other representatives may be chosen to take seat in the GIMI NRG*

GIMI International Reference

The GIMI International Reference Group (GIMI-IRG) will serve as an important body to collect relevant input regarding International view points, policies and technological development from relevant stakeholders in their countries. The organizations involved, listed in Table 2, have been selected to ensure a full involvement of the main international stakeholders in the field as well as to maximize the international potential of the GIMI developments. Importantly, through the direct participation of representatives of national transport authorities, such as Katherine Petros (USA), Sandra Erkens (the Netherlands) and Xu Yian (China), the connection to international problem owners that encourage innovation is guaranteed and makes them aware of the Swedish solutions that are being created.

Another important function of the GIMI-IRG will be to to develop opportunities for international GIMI demonstrations in foreign countries. The advantages of these will be to enable testing the resilience of the GIMI solutions in other climates and socio-technical systems. The GIMI-IRG also expands the research infrastructure available within the GIMI environment (for instance laboratory equipment), gives venues for the GIMI COOP exchange program and allows the Swedish stakeholders to market themselves and their product on the international market.

The GIMI management team (GIMI-MT), will meet once a year with the GIMI-IRG and the GIMI-NRG together to discuss the GIMI activities and developments. At the end of each year the Annual GIMI Performance Report will be send to all members of the GIMI-IRG for their comments, to be discussed in further detail during the meeting. When organizing events (e.g. a GIMI online courses or an international GIMI Conferences) the members of the GIMI-IRG will be informed and consulted for their input, for instance in suggesting lecturers, themes to be discussed or additional events to be organized. The GIMI-IRG will also bring relevant international events into the GIMI environment and actively encage the GIMI members in their activities.

All members of the GIMI-IRG will act as ambassadors of the GIMI environment throughout their organizations and their countries. Membership in the GIMI-IRG is in principle not subject to rotation, as commitment to the environment is important in GIMI. But as the agenda evolves, more members could be added to have a sufficient knowledge base in the GIMI-IRG to reflect new ventures or developments.

Table 2: Organizations involved in the international reference group

Representative(*)	Organization	Country
Katherine Petros	US Federal Highway Administration	USA
Haleh Azari	AASHTO Advanced Pavement Research Laboratory	USA
Sandra Erkens	Dutch Ministry of Transport	Netherlands
Albert Norelius	Swedish Export Council, China	China
Xu Yian	Chinese Ministry of Transportation Highway Research Institute	China
Terhi Pellinen	Aalto University	Finland
Inge Hoff	NTNU University	Norway
Herve di Benedetto	ENTPE University of Lyon	France
Manfred Partl	EMPA Research Institute	Switzerland
Guy Dore	Laval University	Canada
Mofreh Saleh	Canterbury University	New Zealand
Murali Krishnan	IIT Madras	India
Eswaran Subrahmanian	Carnegie Mellon University	USA
Joe Mahoney	Washington State University	USA
Luis Guillermo Loria Salazar	National Laboratory of Materials and Structural Models, LanammeUCR	Costa Rica
Hans de Bruijn	Delft University of Technology	Netherlands
Rolf Dollevoets	ProRail, Dutch Railway Authority	Netherlands
Hilde Soenen	Nynas	Belgium
Alan James	AkzoNobel international	USA

(*) *Subject to their organizations, other representatives may be chosen to take seat in the GIMI IRG*

An inclusive environment

The very ambitious and challenging goals of the GIMI agenda require that a systemic approach be adopted in GIMI which encompasses all aspects of bringing Green Infrastructure Material Innovations to the transport infrastructure sector.
To do so, GIMI advocates a transition from the conventional standalone approach, where only the road owners are charged with finding the solutions to the different sustainability issues of transport infrastructure (and trying to encourage the various stakeholders), to a new paradigm, where *key suppliers and stakeholders work in unison* within an integrated approach, to determine the best solutions for the green infrastructure systems of the future.

Correspondingly, the GIMI environment brings together all stakeholders that are involved in the development and implementation of GIMInnovations.

Reaching all stakeholders

The GIMI vision means that, depending on the stages of the environment's development, different stakeholders may be needed to be actively involved in the environment. At the start of the GIMI Agenda it is important to have those stakeholders involved that have the capacity and resources to take *leading roles* in the environment and act as *ambassadors* in society.

Shortly after the GIMI environment is up-and-running, the developed infrastructure and strong GIMInnovation ambassadors will then attract more stakeholders to become actively involved in the GIMI activities. At this stage SMEs will start having an important role in the GIMI environment. By taking part in the relevant Strategic Sub-Environments, all the GIMI stakeholders will then contribute to the development of the activities and products that eventually result in reaching the GIMI vision. The GIMI environment will thereby cater towards the different incentive structures of the various GIMI partners.

At a further stage, for instance when the research clusters in the GIMI environment start developing products, it could be that more members are needed in specific (foreign) markets or that large scale demonstration sites need to found. Then, another additional pool of partners will be recruited inside the environment.

'GIMI joins partners in a cross-disciplinary structure'

Key GIMI partnerships

Overall, the GIMI Agenda benefits greatly from being strongly grounded both in the infrastructure owner context and the material supply & infrastructure development chain. Key partners in the GIMI Environment are the major Swedish contractors and consultants (NCC, SKANSKA, PEAB, Sweco) that are material producers, material transporters, infrastructure designers and builders, but also (more and more) infrastructure owners (through PPP contracts).

Branch-organisations also play an important role in Sweden in reaching all size industries. For this reason, GIMI is closely connected to branch-organisations representing the aggregates industry, the concrete industry and the construction industry (MinFo, Svensk Betong and IQ Samhällsbyggnad, respectively). Since asphalt is an important material in infrastructure in Sweden today, Nynas and Akzo-Nobel also play key-roles in the environment.

Several projects within the GIMI environment will have vehicle-road interaction aspects in it (e.g. truck platooning, electrical vehicles, Car2Road). To ensure a close interaction with the vehicle industry, SAFER is bringing all the major vehicle manufacturers to the GIMI environment, with a strong focus on the safety aspects.

The GIMI environment involves Sweden's leading research groups and centres of excellence related to transport and materials (KTH, Road2Science, CTS, Eco2, SP Sveriges Tekniska Forskningsinstitut, EIT InnoEnergy KIC, EIT ICT Labs KIC, Materials Platform, Transport Platform, Gaming and Participatory Simulation Labs) to ensure that the most up-to-date advances can be evaluated and implemented in the different activities of the environment.

Standard-setting bodies are of crucial importance in bringing innovations to the infrastructure domain. For this reason, the Swedish Standards Institute (SIS) and Trafikverket are also key-partners in the GIMI Environment from the very beginning. Since GIMI

aims to be on the forefront of innovation, it can be anticipated that as the agenda evolves, more directions are developed and additional key stakeholders are included into the environment to guarantee all the needed expertise in the environment.
By having all the key-partners inside the GIMI environment, a wide coverage over Sweden is established (geographically: almost all regions in Sweden, domains: all major stakeholders). The high level of integration is also reflected in budget allocation over the GIMI SSEs (see assets and budget sections). At the same time, the GIMI environment spans over the most important infrastructure regions in the world (European countries, USA, China, India, Costa Rica, New Zealand).

By having such a wide international reach, GIMI members have the opportunities to market GIMInnovations to a global market and be continuously updated on relevant international developments.

Connecting to other Strategic Innovation Agendas

Since Sweden is aiming at making a consorted effort to become world leading in research, innovation and sustainable developments (e.g Swedish Research and Innovation Bill 2012/13:30 and 2012/13:31) it can be anticipated that various agendas will be formulated over the coming years that may be relevant for the GIMI environment. Similarly, at the European and global scale, such innovation agendas will also be developed (e.g resulting EU's Vision 2020). At the start of GIMI (in 2013), the strategic research and innovation programs that are nationally and internationally proposed and are relevant for GIMI have been identified and connected to the GIMI environment:

Considering that over half of the aggregates produced in Sweden annually go into transport infrastructure applications, an important agenda that GIMI collaborates with is ***MinBas***. Though part of their effort is related to the mining and the steel industry, there are several interfacing topics with GIMI, related to infrastructure where a connection will be made, e.g:
- transport and logistics of aggregates;
- functional material specification of aggregates;
- life cycle perspectives and recycling of aggregates;
- optimized usage of aggregates in infrastructure.

The European institute of Innovation and Technology (EIT) is aiming at making Europe a global leader for innovations in ICT and Sustainable Energy. Via ***EIT ICT Labs***, GIMI has close connections to this effort. As such, GIMI will ensure that the state-of-the-art software engineering and IT services are included in the ICT related GIMI research projects, for examples: Car2Road communication.

The nationally proposed ***ICT-BIM agenda*** is focusing on linking ICT technology to Building Information Modeling (BIM) to ensure that the future Swedish constructions are optimized with regard to their durability, usage of critical resources and include a life-cycle perspective. Since the technology and insights developed in this agenda can be of interest to GIMI, ICT-BIM is closely connected when looking into using building information technology for transport infrastructure.

Sweden, through KTH and Uppsala University, is also collectively working on smart electricity networks and electrical energy storage in cooperation with ABB and Vattenfall in the European Innovation program called ***KIC InnoEnergy***. By being coupled to this innovation agenda, the (inter)national experts and state-of-the-art developments on electrification can be utilized in GIMI projects that are related to energy storage, for example: energy harvesting from roads.

The proposed agenda on '***Nationell Kraftsamling för Transportrelaterad verksamhet till år 2050***' is combining the two major Swedish Strategic Research Areas on transportation at Chalmers/GU and KTH/VTI. The focus of this agenda is to develop future scenarios on how to reduce CO2 by 60% and have zero deaths in traffic by 2050. Since the GIMInnovations have a major contribution to make in these, the environments are closely linked to each other.

'GIMI connects to relevant National, European and Swedish GREEN agendas'

What resources will be committed to the GIMI environment?

(...and how will they be utilized?)

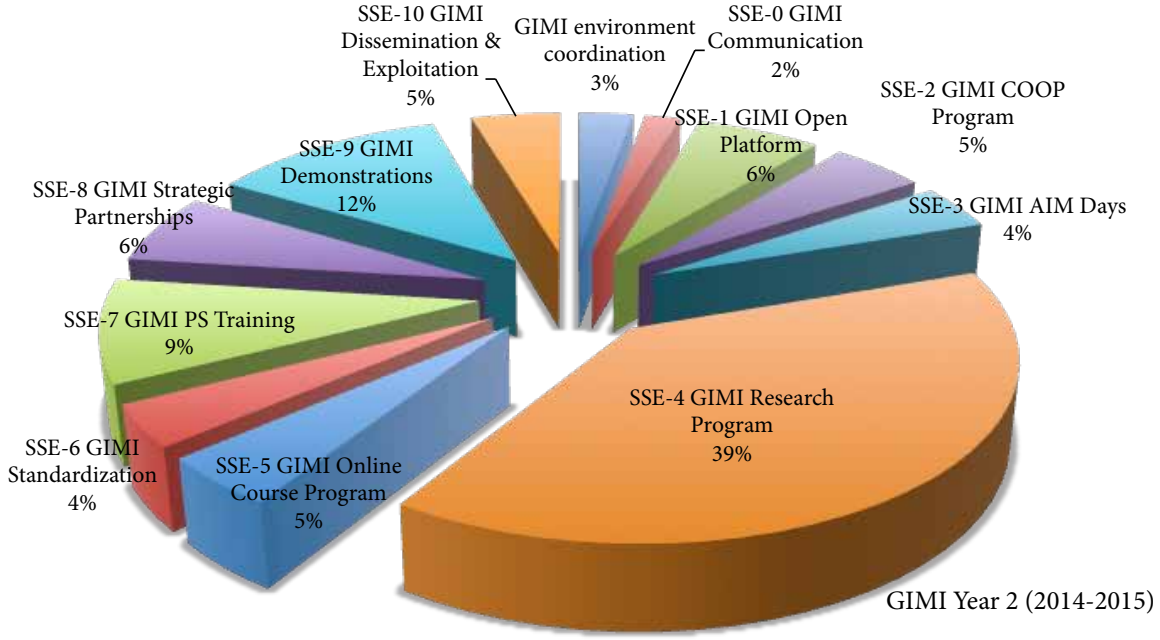
Estimated GIMI budget

The overall financial resources required for the GIMI agenda are estimated at 28 MSEK in its first operational year (2013-2014) and 32 MSEK in its second year. Since its first operational year most of the GIMI infrastructure will be developed, it will then allow for a rapid increase of engagement of additional partners (e.g SMEs) as the GIMI vision will reach more and more partners throughout Sweden.

As such, the GIMI Strategic Sub-Environments will increase their activities an estimated total of 41 MSEK in 2016 and is projected to reach 79 MSEK in 2030. Some Sub-Environments have a relative high initial cost due to start-up development costs, after which their relative costs will stabilize. Other SSEs will have a lower initial cost that increases as the environment matures and becomes more anchored in the sector (e.g exploitation activities).

The budget division over the GIMI Strategic Sub-Environments is closely following the GIMI Road Map. In this, a gradual increase of the number of GIMI Research Clusters, GIMI COOP Scholarships, GIMI PS Training sessions, GIMI Standards and GIMI Courses is expected from 2013 till 2030. As the environment will have an increase in GIMInnovations, the demonstrations and exploitation activities will also increase.

The total projected costs *and* revenues of the GIMI agenda will thus increase as well as the partner commitment to the environment as GIMInnovations and a new generation of GIMI engineers start influencing the sector. After 20 years GIMI is estimated to be running without the need for external funding, since the self-generated revenues and partners contributions will match the costs associated with the GIMI agenda, see Table 3 and Figure 3.



What resources will be committed to the GIMI environment?

GIMI budget division

Collectively, the GIMI Strategic Sub-Environments cover the educational, research and innovation activities in the GIMI environment. Their successful interaction and support of each other will put the knowledge triangle into operation and achieve the GIMI goals. The allocation of the GIMI budget over the SSEs emphasizes the role of the various SSEs: In this, the research program in the innovation environment (taking 40% of the budget), the demonstration activities (covering 12%) and the training of operational people to adopt the innovations (10%) are prominent SSEs. Supported by the industry-academy interaction programs (GIMI COOP: 4-6% and GIMI AIMS: 4-7%) and the GIMI courses (3-6%) that bridge the gap between the stakeholders. Enabling the innovations, the standard setting (5%) SSE and the GIMI Open Platform (3-6%) will then result into implementation and exploitation of the GIMInnovations (4-13%).

The infrastructure of the GIMI environment plays an important role in its efficient coordination and communication. In this, the overall GIMI coordination is important to ensure that all the SSEs follow the GIMI Road Map, are sufficiently connected to each other, all the stakeholders are reached and GIMI is performing well on its Key Performance Indicators. For this, an annual budget of 0.8 MSEK is reserved, which includes the costs for the GIMI coordinator, the administrators, the GIMI MT meetings and the National and International Reference Group meetings. In addition to this, each Strategic Sub-Environment also has their own budget for its coordination, which is included in the individual SSE budgets.

Table 3 Cost overview per GIMI Sub-Environment

MSEK	GIMI Year 1 2013-2014	Year 2 2014-2015	Year 3 2015-2016	Year 4 2016-2017	Year 8 2020	Year 13 2025	Year 18 2030
GIMI environment coordination	0.8	0.8	0.8	0.8	0.8	0.8	0.8
SSE-0 GIMI Communication	0.5	0.6	0.6	0.6	0.5	0.6	0.7
SSE-1 GIMI Open Platform	1.8	2.0	1.9	1.7	1.8	2.0	2.2
SSE-2 GIMI COOP Program	1.0	1.5	2.1	2.6	2.9	3.2	3.5
SSE-3 GIMI Academy Industry meeting days	1.0	1.3	1.6	2.0	3.5	4.7	5.1
SSE-4 GIMI Research Program	10.7	12.5	14.3	16.1	20.9	23.1	25.5
SSE-5 GIMI Online Course Program	0.8	1.4	2.1	2.8	3.0	3.2	3.6
SSE-6 GIMI Standardization	1.4	1.2	1.4	1.5	2.1	2.9	3.9
SSE-7 GIMI PS Training	2.4	3.0	3.6	4.2	6.4	7.2	7.9
SSE-8 GIMI Strategic Partnerships	2.5	2.0	2.1	2.1	2.3	2.5	2.8
SSE-9 GIMI Demonstrations	3.4	3.8	4.2	4.6	6.4	8.2	9.4
SSE-10 GIMI Dissemination & Exploitation	1.2	1.4	1.8	2.2	4.0	6.7	9.8
Total	27.6	31.7	36.5	41.3	54.6	65.2	79.4

The SSE-5 GIMI Online Course Program will start with a budget of 0.8 MSEK in its first year, growing to 2.8 MSEK by 2016 and reaching an annual 3.6 MSEK by 2030. This includes the coordination as well as the courses and course material development. The SSE-7 GIMI PS Training starts with an expected budget of 2.4 MSEK in its first year, growing to 4.2 MSEK by 2016 and reaching 8 MSEK in 2030. This includes the coordination costs, the actual training sessions and the training material development. The latter, being directly linked to the transfer of innovation knowledge to operational people, will evolve very much in parallel with the innovations resulting from the GIMI research projects.

The SSE-4 GIMI Research Program plays an important role in the GIMI environment as it is the source of knowledge creation that will lead to the product and innovation developments. Starting with an initial 10.7 MSEK to start the first research clusters in 2013, the SSE-4 will increase to 16 MSEK by 2016 and is expected to grow over 25 MSEK beyond 2030. As *demonstrations* are important activities to test and visualize the GIMInnovations on a large scale and integrate them to other technologies, before diffusing them into the infrastructure sector, SSE-9 also has a dominant role to play in the environment. This strategic sub-environment starts therefore with a budget of 3.4 MSEK in GIMI's first year, growing to 10 MSEK by 2030.

The *standards* development play hereby an important role since, without standardization, innovation is hard to implement in the infrastructure sector. For this reason SSE-6 will regularly perform market analyses to document the needs of the sector. As performance based standards require close links to the innovation environment, SSE-6 will be closely linked to the GIMI research projects. For this reason, SSE-6 is estimated to need 5% of the total budget which includes travel costs to participate in the international standards setting committees to advocate the GIMI standardization.

The GIMI Open Platform serves as the window of GIMI to society and, as such, plays an important role in reaching the *vision* of the GIMI agenda. Initially, most effort will go into the building of the open platform and, later on, to the constant development of new functionalities as more GIMInnovations are generated from the environment. Because the GIMI Open Platform is developed in active participation of all its members, its development will include the stakeholders' needs and ideas. For this an annual

budget around 2 MSEK is estimated.

The GIMI Coop Program (SSE-2) and the GIMI Academy-Industry Days (SSE-3) have important roles in establishing interaction between the various stakeholders. By bridging the gap between academy and industry and by developing a new generation of engineers that incorporate the GIMI philosophy in their daily practise, innovation will start diffusing in all aspects of the sector. As such, these GIMI Strategic Sub-Environments also serve as important tools to create commitment of partners to the environment and anchoring the GIMI vision into society.

Following the GIMI Road Map, the GIMI COOP Program will provide a gradual increase of the number of GIMI Scholarships and GIMI Workshops to present the COOP results. For this, 1.0 MSEK is reserved in its first year, growing to 3.5 MSEK by 2030. SSE-3 coordinates the academy-industry days, which includes the costs of the coordination, the annual fee to Uppsala university for using the AIM Day concept, the costs of the expert panel guests and the meeting costs of all the academy-industry days. For this, an annual cost of 1 MSEK in 2013 is expected, growing gradually into a dynamic sub-environment.

The SSE-8 is coordinating the strategic partnerships within the environment, which will require meetings with stakeholders and targeted dissemination of the GIMI activities. The costs for this are estimated to be 2-3 MSEK annually. The GIMI SSE-0 Communication is estimated at 0.5 MSEK, which includes the costs of the communications officer as well as the overall GIMI dissemination efforts such as, for example, the bi-monthly GIMI Newsletter.

Resources to be committed

To finance the GIMI agenda, an annual co-funding of 20 MSEK for the first 10 years is requested from VINNOVA through its long-term Strategic Innovation Area (SIO) program, with an anticipated gradual reduction in the following 10 years, Figure 3.

The partner commitment to the environment is initially expected to be mostly in-kind, for example in GIMI research projects, GIMI courses and GIMI meetings and Academy-Industry meeting days. This, over the years, is expected to gradually extend towards also an increase of the direct monetary contribution. Such contributions are expected to go, for example, towards partially funding of research projects and courses, supporting GIMI COOP Scholarships, enhancing the GIMI infrastructure or hiring GIMI oriented staff.

The initial in-kind contribution is important for the GIMI agenda, since it will bring a committed effort from its partners as well as a shared responsibility for its success. There are several in-kind contributions that industry partners will commit to the environment, beyond the time that individuals spend on the GIMI activities. An important example is contributing the availability of large-scale demonstrations sites. When building a new road, the transport authority and contractors will, for exam-

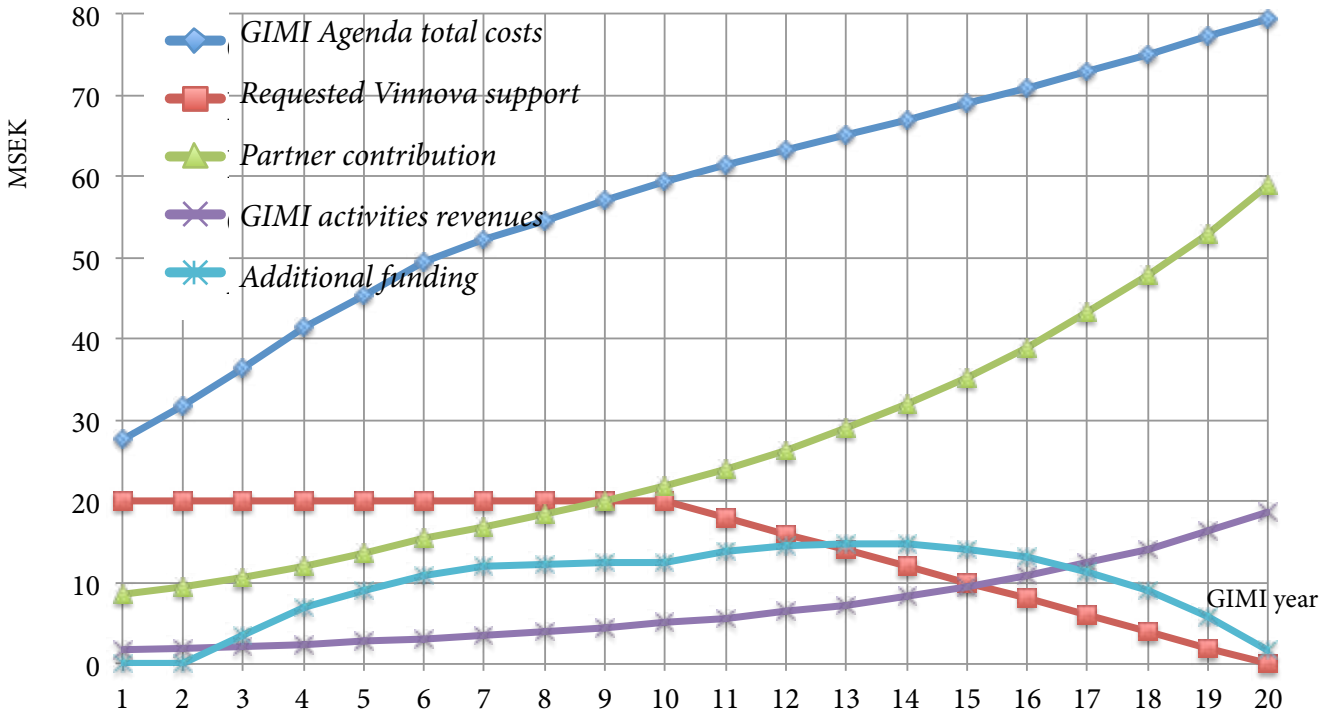


Figure 3: Long term GIMI cost-revenue prediction (year 1: 2013-2014, year 8: 2020, year 18: 2030)

What resources will be committed to the GIMI environment?

ple, allow for local embedding of GIMInnovations. Some partners already have invested in large-scale facilities which can be extended to embed GIMInnovations, for example SAFER's ASTAZERO test track in West-Sweden or SP's demonstration sites throughout Sweden. Another example is the availability of the far-reaching arms and networks of its partners, for example from the standard-setting bodies, such as Trafikverket and SIS, the academic partners or the material suppliers. Finally, there are currently activities ongoing that would fit within the GIMI environment. The GIMI MT and its members will actively identify these activities (e.g. ongoing research projects) and pursue the inclusion of them into the GIMI environment.

The estimated partner contribution is thereby estimated to evolve from an initial 8.6 MSEK in its first year, to 12 MSEK in 2016, reaching over 50 MSEK after 2030.

Additional financing

Over the projected 20 year, GIMI will seek additional external funding. From the expected costs and revenues, Figure 3, it is expected that the GIMI environment will need to increase its external funding to a gradual increase of 15 MSEK over its first 14 years, after which a gradual reduction till 2030 would be needed to cover the total costs of the environment.

Such additional funding will include national and international research and innovation programs focussing on a sustainable society, research efficient urban developments and technological advances to diminish the wasteful use of resources. Programs, specifically catering towards transport infrastructure, the building sector, material development and supply-chain optimization will also be explored since they are highly relevant for the GIMI agenda. More specialized topics such as, for example, functionalized materials, ICT and transport, energy efficient infrastructure, optimized transportation or improved infrastructure procurement are also envisioned to be included in future research proposals.

Currently, several innovation initiatives are ongoing which will be approached for funding activities of the GIMI agenda. For example, the Swedish Energy Agency, Formas, the KIC programs and the European Union's Horizon 2020. Since GIMI is a long-term agenda, it can be anticipated that many additional international and national innovation programs will start up over these years. It is the role of the GIMI coordinator and the GIMI SSE coordinators to identify these venues and develop funding proposals. The SSE-8 on Strategic Partnerships will be especially active in identifying national and international partnerships that can be relevant for the GIMI environment and this Strategic Sub-Environment will be active in lobbying and discussing the GIMI vision with other innovation agenda's and programs.

GIMI Revenues

The expected revenues from the GIMI environment include memberships fees, GIMI course fees, GIMI PS training fees and incomes from GIMI patents and GIMInnovations. It is anticipated that these would initially start at 1.8 MSEK in the first year of operation and increase to 2.5 MSEK in 2016, growing rapidly towards a projected 40 MSEK in 2030.

The revenues will start increasing as more and more GIMInnovations start diffusing into society. They, together with the partner contributions, play an important role in making the GIMI agenda self-running and independent of external funding. The revenues coming from the GIMI environment are included as an important Key Performance Indicator (KPI) to annually monitor the health and long-term sustainability of the agenda.

How to measure the GIMI impact?

(...long term and short term key performance indicators)

‘GIMI attracts the *best talents* and attracts GREEN entrepreneurship’

Performance Indicators

GIMI is a large long-term strategic research and innovation environment and, as such, needs a structured way of monitoring its performance. The various industries have different perspectives on how quality or progress can be measured. Since many different stakeholders are involved, the long term GIMI vision with the system’s perspective needs to be maintained throughout the environment to reach the ultimate vision of the agenda.

For this reason, clear quantifiable GIMI Key Performance Indicators (KPIs) are defined, based on the knowledge triangle concept. These KPIs will be used to annually measure and report:

- the *output* of the GIMI agenda (versus its input);
- the need for *improvements* in the GIMI structure or in any of the strategic sub-environments;
- the *progress* of the environment towards its strategic goals according to the GIMI Road Map.

An additional advantage of setting the GIMI KPIs is that it formalizes the priorities of the environment in a transparent manner. In the following, an explanation is given of the GIMI KPIs. In Appendix 3 an overview of these is given in a schematic format along with a short description of how this KPI fits the vision of the GIMI agenda.

KPI-1: GIMI graduates

The GIMI environment nurtures and attracts a new generation of ‘GIMI graduates’*(*)* that embrace and contribute to its vision. In the environment, educational and research activities are developed that will be attracting this new generation. The academic and industrial network will then be able to provide opportunities for the graduates once they go to the job market. To monitor the performance of the GIMI environment with respect to this, the number of students *(**)*, new graduates, new recruits and attractiveness of the educational and research programs need to be measured. For this, the following KPIs are defined:

KPI-1.1: number of students in the environment

The number is a size of stock, independent from the year in which the students are.

KPI-1.2: number of GIMI scholarships awarded

A GIMI scholarship (e.g. via GIMI SSE-2) is considered awarded if the scholarship agreement has been signed between the student and the grant institution or if money has been paid to cover costs in the exchange program.The KPI counts only scholarships for those students which start the exchange in the given year.

KPI-1.3: number of ‘mid career’ GIMI professionals retained

A mid-career GIMI professional is a GIMI graduate that has earned a regular (full-time) salary for at least 12 months before returning to the GIMI environment. The retrained mid-career professionals are a sub-set of the total number of graduates.

KPI-1.4: number of new GIMI graduates

‘New’, meaning within the year of reporting.

KPI-1.5: number of ‘students’ inserted in the labour market in the GIMI environment

The number of GIMI graduates whose first job position within 6 months of graduation is related to green infrastructure materials. The basis of calculation are graduates from any given year.

KPI-1.6: first salary when entering labour market

The average first year salary of GIMI graduates in their first position after graduation. The basis of calculation are graduates (separate for industry, BSc, MSc and PhD tracks) which picked up their first job in the reported year. Graduates from Executive Education or Industry courses are not considered.

(*)‘GIMI graduates’ are students that have received one or more certificates of having completed a course or research project within the GIMI environment.
(**) ‘Students’ include: bachelor (B.Sc.), master (M.Sc.), executive education (ExecEdu) or postdoctoral (PhD) students. It also includes operational staff that participates in a GIMI course.

KPI-2: GIMI publications

GIMI strongly encourages dissemination of the results generated from within the environment. An important part of such knowledge spread will go via publications. Since the environment consists of academics, industry partners and government bodies from various disciplines; various publication types

will address different audiences. To measure the efforts made of reaching these, the following KPIs are defined:

KPI-2.1: Number of GIMI scientific journal publications

KPI-2.2: Number of GIMI conference publications

KPI-2.3: Number of GIMI licentiate theses published

KPI-2.4: Number of GIMI PhD theses published

KPI-2.5: Number of GIMI popular media publications

KPI-2.6: Number of GIMI articles in newsletters or magazines of related branches

In KPI -2.1 till 2.6: A publication is considered to be a 'GIMI publication' when it concurrently fulfils two criteria:
(i) the results are related to the work carried out in the GIMI environment;
(ii) it acknowledges support received from GIMI.

KPI-3: GIMI ventures

GIMI is creating an environment where new processes of collaboration and communication are developed. Stakeholders that normally would not meet each other outside of, potentially competitive, market situations, now meet each other in an informal setting. By doing so, GIMI is aiming to be fertile grounds for creativeness and out-of-the-box thinking. To measure the performance of this, the number of creative ideas that are actually brought towards realization should be monitored. For this reason, the increasing number of business ideas, incubated within the GIMI environment, will be measured as follows:

KPI-3.1: Number of formalized commitments established between GIMI and entrepreneurs

These commitments should clearly state the commitments that the venture is accepting and, if applicable, what the venture gives in exchange.

KPI-3.2: Number of GIMI start-ups created

Such a GIMI start-up:

- must be legally incorporated according to Swedish *(*)* national law;
- must have won its first customer(s) or demonstrate the existence of a potential first customer or investor (for example by a Letter of Intent).
- must fulfil either one of the following conditions: (i) it has been coached/incubated within the GIMI environment or (ii) it is a spin-off arising as direct output of a GIMI activity.

(*)In case the spin-off is established outside Sweden through the GIMI international network, it should be legally incorporated according to that country's law.

KPI-4: GIMI growth into existing industries

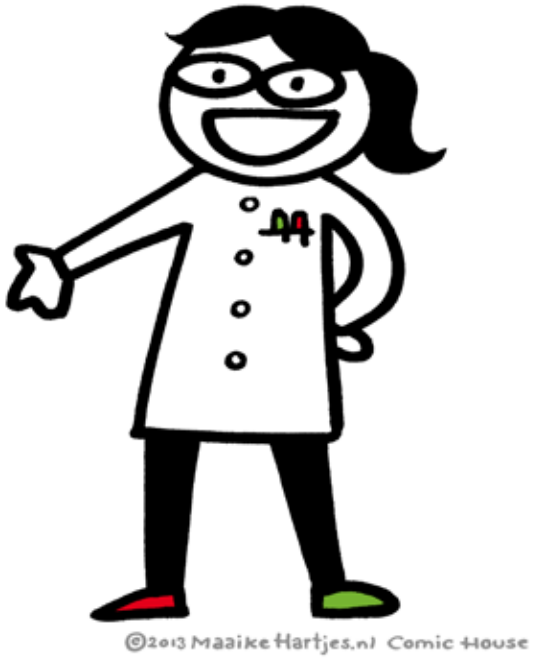
In addition to new ventures coming from the environment, GIMI must also establish innovation growth into *existing industries*. Knowledge assets and new or improved products/services/processes are created within GIMI projects by the partners participating in it. The knowledge assets (patents, copyright, know how) are owned by the partners of the projects that contribute to create them. Those partners might use them for their own purposes, or might license them to third parties. The following KPI will be used to measure GIMI growth into existing industries:

KPI-4.1: Number of GIMI knowledge adoptions

Knowledge asset substantiated by a declaration of the partner that the partner is implementing the GIMI knowledge in its processes.

KPI-4.2: Number of GIMI knowledge transfers

Knowledge asset substantiated by a licensing agreement (patents, copyright) or service contract (licensing, sales or consultancy).



A knowledge adoption or transfer is counted as a GIMI adoption or GIMI transfer if:
(i) The transferred or the adopted knowledge is the output of a GIMI activity
(ii)There is a written statement of the GIMI Partner that states how these outputs have been adopted (in the case of knowledge adoption by a GIMI Partner) or there is a knowledge transfer agreement between the originating GIMI Partner and the party (GIMI Partner or third party) receiving the knowledge.

KPI-4.3: Number of new or improved products/services/processes that are direct output of a GIMI activity and their TAM values

In this, the new or improved product/service/process must be acknowledged by a first commercial transaction (e.g. an invoice) or proof of demonstration of the added value to the customer . To be counted as output from a GIMI activity, the originating party must be a GIMI Partner, a GIMI Legal Entity or a GIMI start-up.
The Total Addressable Market (TAM) value is the revenue opportunity available for a product or a service, calculated via EU regulations.

KPI-4.4: The number of improved products/services/processes adapted with GIMI technology

A company is implementing IP Foreground resulting from a GIMI project into its own processes. This KPI measures the number of processes which are improved with IP Foreground

KPI-4.5: Number of industries/institutes/governmental agencies adopting GIMI innovations

A party is adopting IP Foreground resulting from a GIMI project into its own processes.

KPI-5: GIMI Industries

GIMI considers its industry partners as crucial already in the design phase of an innovation project, because the industry partner ideally also is the first customer for the innovation resulting from the project. Since GIMI is about bringing green infrastructure material innovations to the market, the participation of the industries in the environment is an important assessment number to show the attractiveness of the environment for the sector.

KPI-5.1: Number of industries contributing to the GIMI environment

An industry partner is any organization which provides services and/or products on the market for a profit. An industry has to fulfil concurrently two conditions to contribute to this KPI:
(i) the partner has signed the GIMI Project Agreement.
(ii) the partner is reflected in the annual performance report (or past annual performance reports) as having actively contributed to GIMI activities.

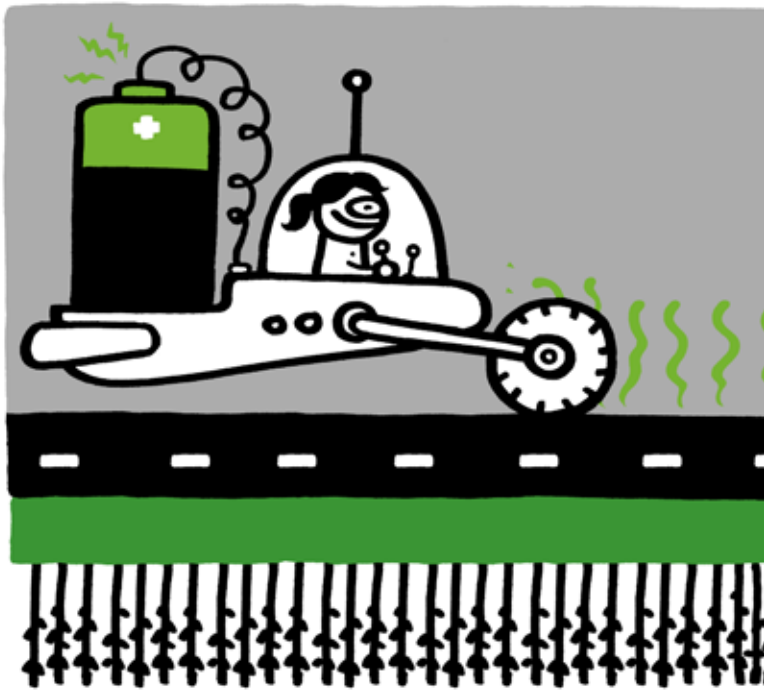
This means that industry whose contribution to the GIMI environment is merely the provision of services/products to a GIMI project at a competitive market rate does not fall under this definition.

KPI-5.2: Input from these industries into the GIMI environment

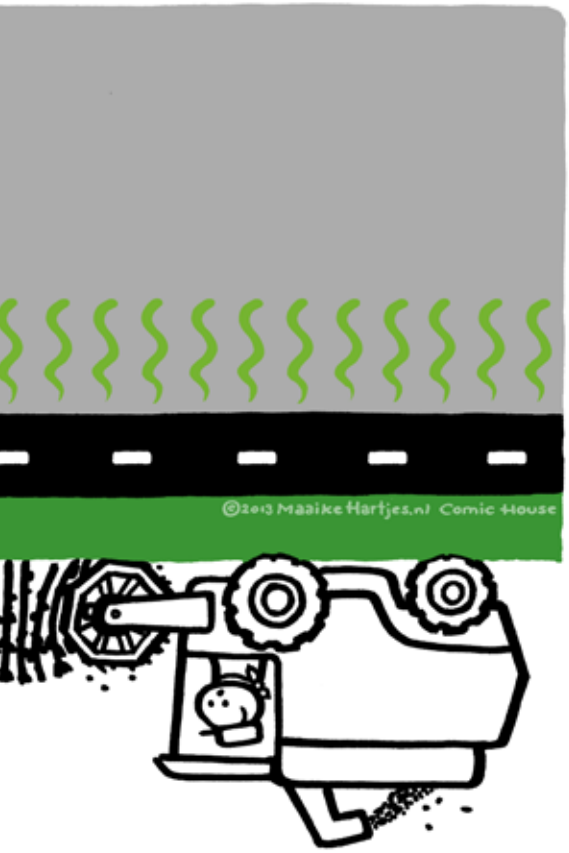
This will be separated into 'in kind' (e.g.: unpaid time spent on GIMI activities, unpaid contribution to the GIMI research infrastructure), monetary input , knowledge sharing (e.g. non-publicly available information) and GIMI dissemination activities.

KPI-6: GIMI SMEs

An important part of the transportation infrastructure sector consists of SMEs. Often originating from family owned businesses, GIMI is enabling SMEs to connect to larger (multi-national) industries and academic partners to speed up the national knowledge base.
Many initiatives will be developed within the GIMI environment to ensure that SMEs also want to become part of the environment and that they see the benefit for their own company to take part in the



‘Enabling Swedish SMEs to connect to larger multi-national industries and academic partners will speed-up our national knowledge-base’



GIMI agenda. Even though KPI-4.1 and KPI-4.5 measure the GIMI growth in existing businesses, considering the importance of the SMEs, two separate KPIs are defined to keep track of the SME involvement in GIMI:

KPI-6.1: Number of SMEs contributing to the GIMI environment
An SME is an industry partner, as defined under KPI-5.1, that additionally fulfils the following criteria:
(i) it has less than 250 employees and
(ii) its annual turnover is <500 MSEK or its balance sheet total is <430 MSEK

KPI-6.2: Number of SMEs adopting GIMI technology
Number of SMEs that is adopting IP Foreground resulting from the GIMI environment into its own processes.

KPI-7: GIMI Projects

The GIMI environment stimulates the initiation and development of research projects that have a clear impact on green infrastructure material innovations. This can, for instance, be related to the processing, transportation, planning of usage, design or maintenance of GREEN infrastructure materials. It can also be related to enhancing the application of GIMI products in the daily engineering practise or about developing tools that will encourage green infrastructure procurement. The GIMI Strategic Sub-Environment 4 will be coordinating the GIMI research projects.
To measure the performance of the environment, a number of KPIs are defined:

KPI-7.1: Number of active GIMI research projects

KPI-7.2: Number of completed GIMI research projects

KPI-7.3: Number of GIMI research projects that integrate 2 or more disciplines

KPI-7.4: Number of GIMI research projects that have 3 or more stakeholders involved

KPI-7.5: Number of active research projects in the GIMI environment that have SME partners

In KPI -7.1 till 7.5: A research project is considered to be a ‘GIMI project’ when it concurrently fulfils two criteria:

(i) the project is performed within the GIMI environment;
(ii) it has received support from GIMI.
In which ‘industry partner’ is as defined under KPI-5.1.

KPI-8: GIMI Courses

The GIMI Strategic Sub-Environment 5 will be directing the development of the GIMI course program. A large part of this effort will go towards online course development to cater towards industrial and remote partners that are on different time-zones or that may not be able to spend working hours on following courses or travelling away from their jobs.

The GIMI courses aim at lifting the knowledge level of the entire infrastructure sector, through all the hierarchies, and will distribute knowledge of research advances. To ensure that the content and level are appropriate for the intended audiences (e.g. operators, B.Sc., M.Sc, PhD, executive managers), the GIMI courses will be developed in collaboration between GIMI partners from various disciplines.

To assess the performance of the GIMI education developments, a number of KPIs are defined related to this environment:

KPI-8.1: Number of GIMI courses given

KPI-8.2: Number of online GIMI courses given

KPI-8.3: Number of GIMI completed course certificates granted

KPI-8.4: Number of GIMI courses given more than once

KPI-9: GIMI Demo's

Dissemination of the GIMI output, in addition to publications, will also be done via presentations and demonstrations. Presentations at various venues are important to reach various stakeholders. Building pilots and developing demonstration sites is an important aspect of developing innovations in the infrastructure sector. Used on operating only with 'proven concepts', demonstration sites are excellent opportunities for the environment to test and try out GIMInnovations on a larger scale, before actual field application. The Strategic Sub-Environment 9 will be coordinating the GIMI demonstrations. To evaluate the performance of this environment, a number of KPIs are defined:

KPI-9.1: Number of GIMI demonstration sites

A GIMI demonstration site is: (i) a pilot that is build to test and demonstrate a GIMInnovation or (ii) an existing pilot that is incorporating a GIMInnovation.

KPI-9.2: Number of GIMI demonstration events

A GIMI demonstration event is an event which is carried out with GIMI as the leading actor with respect to organisation, definition of speakers and decision of content.

KPI-9.3: Number of events where GIMI is attended & participating

These are events where GIMI is not the leading actor, but represented with a speaker, an exhibit, or as a sponsor.

KPI-10: Sector change

Since GIMI is creating an environment that is catering towards change at acceptable risk and maximum gain, there should eventually be a change in the operations of the stakeholders adopting the GIMInnovations. GIMI encourages 'build-in' not 'bold-on' innovations, since this is more sustainable.

The GIMI SSE-1 (GIMI Open Platform), the GIMI SSE-3 (GIMI Academy-Industry Meeting days), the GIMI SSE-7 (GIMI FRAME GAMES) and the GIMI SSE-10 (GIMI Dissemindation & Exploitation) are focussing on establishing this. To measure the performance of these environments, the following KPIs have been defined:

KPI-10.1: Number of GIMI Open Platform Users

In which a 'user' is defined as a person that visits the platform on a frequent bases and has made use of the information provided there (e.g. courses, Apps, tools, networks) in his/her work.

KPI-10.2: Number of GIMI Academy-Industry Meeting days organized

KPI-10.3: Number of GIMI FRAME GAMES developed

KPI-10.4: GIMI member annual feedback

Processing of the feedback from the annually performed questionnaire amongst the GIMI members. From this the 'believes' and 'gut feeling' towards implementation of GIMInnovations will be monitored amongst those involved in the GIMI environment.

KPI-11: Standardization

The GIMI agenda has set a very clear focus on enabling performance based standards that are developed in collaboration with its stakeholders. As such, the GIMI environment will ensure that the Swedish GIMInnovations will fit within the future international standards as well as have supporting standards to implement the innovation in the home markets.

The GIMI Strategic Sub-Environment 6 is directing this effort in the GIMI agenda. To measure how well this environment is performing, the following KPIs are defined:

KPI-11.1: Number of GIMI members in Standardization Committees

KPI-11.2: Number of GIMI standards developed

In this a 'GIMI standard' is an (inter)national standard in which GIMI influenced its modification, development or establishment as a standard.

KPI-11.3: Number of projects in which the GIMI standards were utilized

KPI-12: GIMI revenues

Since GIMI is an industry led agenda, the revenues created from within the environment are a measure of its health and its long-term sustainability. Even though it can be envisioned that the first years of its existence this will not be large, the eventual increase in GIMI revenues are an important performance indicator. To keep track of this, the following KPIs are defined:

KPI-12.1: Total revenue from monetization

This KPI measures the total revenues for GIMI, from innovations projects and equity.

KPI-12.2 The rate by which the percentage of the government funding vs the total budget decreases

KPI-12.3: The relative increase of donations in current year against last year

KPI-12.4: Relative increase of total budget in current year against last year

KPI-13: GIMI awards

Since GIMI is an innovation driven environment that aims at being on the forefront of green infrastructure material innovations, it is important to measure to what extend the GIMInnovations are indeed regarded as remarkable. For this reason this KPI is focussing on keeping track of the awards given to the GIMI environment.

KPI-13.1: The number of awards given to the GIMI environment and the GIMI partners

An 'award' is hereby defined as any of the following:
(i) a public recognition of the excellence of GIMI or a GIMInnovation in any or several aspects of the knowledge triangle (or its integration). The award does not have to come with a token or a price.
(ii) a public recognition of a member from the GIMI environment
(iii) a public recognition of a third party making use of a GIMInnovation (in which the award has to be related to that innovation)

KPI-14: GIMI's international presence

The GIMI environment puts a lot of effort on creating a presence on the international field related to green infrastructure innovations. The GIMI SSE-8 (on Strategic Partnerships) and the GIMI SSE-10 (on Dissemination & Exploitation) will develop focussed activities to enlarge GIMI's international presence. In addition to these, the GIMI International Reference Group is also put in place. To measure the performance of these GIMI Environments, the following KPIs are defined:

KPI-14.1: Number of international students active in the GIMI environment

Where by specifying the sub-environment in which they are active.

KPI-14.2: Number of GIMI publications with 1 or more international author

KPI-14.3: Number of formalized GIMI commitments between Swedish and international parties

A GIMI commitment is originating from the GIMI environment or from a GIMI spin-off activity.

KPI-14.4: Number of GIMI knowledge adoptions, tranfers or innovations that are accepted by an international party

KPI-14.5: Number of international entities that are active in the GIMI environment

International entities are non-Swedish industries, SMEs, research institutes or governmental bodies.

KPI-14.6: Number of GIMI projects that have 1 or more international partner(s)

KPI-14.7: Number of international GIMI demonstration sites

KPI-14.8: Number of GIMI members in International Standardization Committees

KPI-14.9: Amount of GIMI revenue originating from iternational activities

KPI-14.10: Amount of international GIMI awards

How to kick-start the GIMI environment?

(...and what projects will start in 2013)

Following the Road Map

To ensure that the GIMI milestones are reached, the GIMI activities will closely follow the GIMI Road Map from 2013 till 2030. The Key Performance Indicators (KPIs) will thereby be used as an annual performance measurement to keep track of the developments and monitor if any modification of a Sub-Environment, a GIMI structure or activity is needed. In the first year of operations, the GIMI Road Map will focus on:

- Starting up all the GIMI Strategic Sub-Environments;
- Developing the infrastructure for the successful coordination of the GIMI agenda and
- Disseminating the GIMI vision and activities to a larger audience.

'By building up the GIMI Open Platform new members will be attracted to the environment'

GIMI Research Clusters

Being the driving force of the innovation within the environment, the GIMI research projects are the backbone of the agenda. To reach the GIMI vision, the research projects are organized in clusters to optimise their individual impact, within SSE-4. In 2013-2014 the first clusters are expected to start, after which in 2014-2015, 2-4 additional clusters are expected to start (see GIMI Road-Map).

SSE-4 will be actively inviting, collecting and evaluating all research ideas from within the GIMI Environment. These ideas can originate from many sources in the GIMI environment through the GIMI infrastructure. But since at the start of the agenda the GIMI infrastructure is still being developed, the first research clusters will be defined by the members in the SSE-4. As the environment further matures, these ideas are anticipated to come more and more come from various directions within the GIMI environment (e.g from industry or governmental partners or from a GIMI Academy-Industry meeting day). In this, SSE-4 will ensure that all the necessary stakeholders are involved and the suggested projects fit within the GIMI vision.

GIMI window to society

The GIMI Open Platform is an important GIMI infrastructure that serves as the window towards society. Being a web-based forum in which the latest research advances from the GIMI sub-environments are found, the Open Platform will also be used as a one-stop-shop to find out which GIMI activities are planned and how members can take part in these.

The GIMI Open Platform will also allow for an easy connection of stakeholders to work together towards specific GIMI goals. As the GIMI environment matures, the Open Platform will serve as a dynamic environment that disseminates the activities of the environment and enables additional members to take part in the GIMI vision.

Since the Open Platform is an important aspect to reach the vision of the GIMI agenda, emphasis will be placed on building this platform up in its first operational year. Working as a catalyst for engaging further memberships and spicing new partners to start becoming active in the GIMI environment, by the end of 2014, SSE-1 is expected to have the Open Platform up and running.

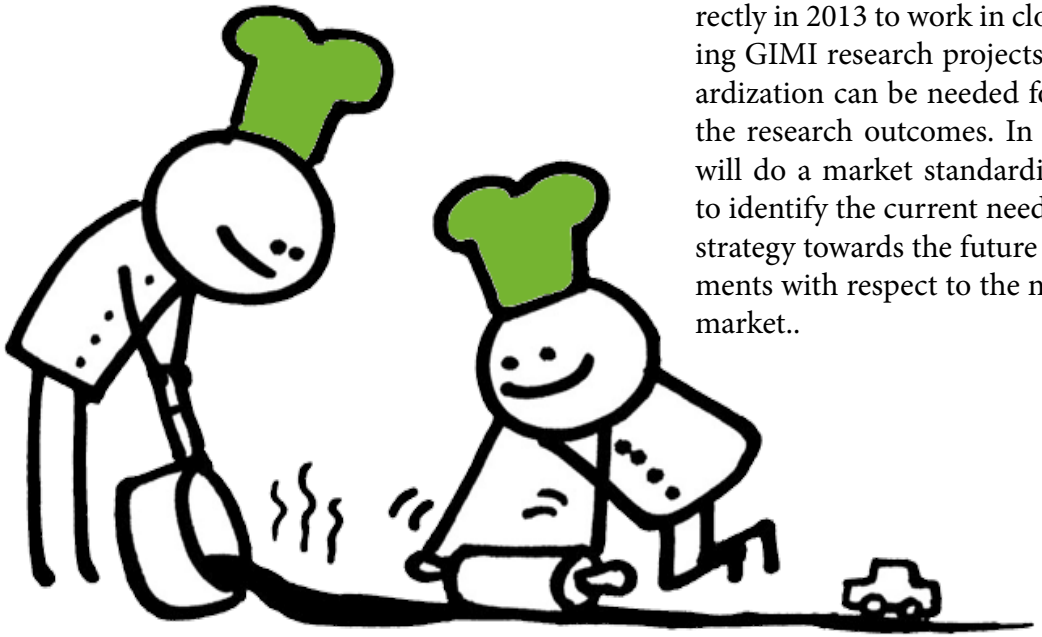
GIMI COOP exchanges

The GIMI COOP program will develop different tracks focussing on bridging the gap between its stakeholders and raising a new generation of engineers with a GIMInnovation mindset. Developing an exchange program in which operational staff can switch places with another member in the GIMI environment will be an import aspect of the GIMI COOP program. Within the program, members can spend time at the facility of one of the other GIMI members. During such an exchange, partners can work together on focussed GIMI projects, learn about each other's daily operations or be educated about specific technology that is needed for the development of a GIMInnovation. In 2013, the structure and tracks of the GIMI COOP program will be finalized and launched within the GIMI environment and the first scholarships will be granted.

GIMI Demonstrations

The interaction of GIMInnovations with traffic and the environment, their interaction with new components, new vehicles or new circumstances entails a need for testing the entire system. SSE-9 will work closely with the GIMI Research Program to identify the projects within the GIMI environment in which a technology needs to be tested via large scale demonstrations.

Since large scale demonstrations often take a significant amount of time, budget and interaction between stakeholders, in 2013, SSE-9 will directly start with the identification and setting up of potential GIMI demonstrations. This includes planned test-tracks, planned infrastructure that can include GIMInnovations and existing national and international demonstration sites.



First GIMI PS Training

The Participatory Simulation Training in SSE-7 will be bringing different stakeholders together, showing each other the complexity of their own daily choices and being confronted with the effects each individual has on the collective system when introducing a GIMInnovation to the system.

Additionally, it allows for training of operational staff in handling GIMInnovations and identify bottlenecks in the entire system when GIMInnovations will be brought to practise. Taking a GIMInnovation from invention to implementation, a first PS Training is expected to be held in 2013-2014 with all the stakeholders.

GIMI market strategy

Since performance based standards are an important aspect of the GIMI Road Map, SSE-6 will start directly in 2013 to work in close contact with the starting GIMI research projects to identify where standardization can be needed for the implementation of the research outcomes. In additional to this, SSE-6 will do a market standardization demand mapping to identify the current needs and make a clear GIMI strategy towards the future standardization developments with respect to the national and international market..

GIMI's first online course

The on-line course program is an important aspect of the GIMI environment to raise its innovation ability. The teachers of the courses will be selected from within the GIMI environment. SSE-5 will also develop 'train-the-teacher' courses to lift the collective ability of the GIMI environment to educate and teach innovation. In 2013-2014 it is expected that the first on-line GIMI course and the first 'train-the-trainer' courses will be organized by the SSE-5.

Enlarging Membership

The current GIMI members are based on the partners that have been developing and discussing the ideas of GIMI over the past year. It is important that this strong inter-disciplinary team leads the SSEs into sufficient momentum in its first couple of years. While the GIMI environment starts building its infrastructure and activities, more and more places will become available for additional partners (e.g SMEs). In 2013-2014, through the strategic partnerships of SSE-8 and the dissemination activities of SSE-0 and SSE-10, more stakeholders in the Swedish society will become aware of the GIMI agenda. Then, through the Open Platform, they:

- become a GIMI members;
- fill in the New GIMI Members form and
- select in which types of activities they want to invest their membership fee.

In addition to this, all members in the GIMI environment are also committed to bringing the GIMI environment to the attention of additional members, serving thus as GIMI ambassadors.

How did the GIMI agenda come about?

(...and what steps were taken?)

‘The time to work on a problem is *after* you have solved it’

The Road to Science...

In the fall of 2011 a discussion was held at KTH between academics and industry representatives that a closer engagement was needed between research activities, students and daily operations in the field of highway and railway engineering. The students and academics felt that they were not sufficiently engaged with the issues that the associated sector was dealing with. Industry expressed that they would like to have more trained engineers and focussed research done that would help them lift their daily practise.

As a results of these discussion, in May 2012 the KTH Road2Science Center was inaugurated focussing on infrastructure technology, stating its vision as:
‘initiate, guide and stimulate research and development between academia and industry to enhance the industry and society’s ability to meet current and future demands for effective ground infrastructure while strengthening the relevant parts of the Swedish construction industry’.

The Center defined that it would build up its effort on three legs: education, research and internationalization with and for industry. As a first step towards defining its strategy, all the industry members were asked to fill in a LIFE (Level of Interest and Feedback) form, in which they were asked to answer several questions about the Center: their worries, their wishes and their own contribution.

From these LIFE form, among others, a priority of research and innovation topics was made. These topics included life cycle assessment (LCA) tools, optimized infrastructure design, longer performing infrastructure, greener infrastructure materials, smarter infrastructure and greener production of infrastructure materials.

Cross disciplines

Simultaneously, the Platforms at KTH started becoming more and more active in creating venues and initiatives that allowed for a cross-fertilization of researchers working on specific themes throughout different departments, schools, Centers and research programs. In these discussions, the *Materials Platform* identified a strong need for the utilization of advanced characterization and modelling techniques for greener building materials.

At the same time, the *Transport Platform* started brainstorming about the future topics in transport. Examples of these included ‘truck platooning’ to reduce the fuel usage and ‘on the road charging’ for electrical vehicles. When thinking these concepts through and discussing them with various industrial partners, the idea emerged that *materia*l would also become an important component in these technologies.

The researchers concluded that a *systemic approach* must be taken, in which not merely the vehicle side is optimized, but also the effect of the vehicle on the infrastructure, and the effect of the infrastructure on its material usage, and the effect of the material usage on its production and that this entire chain should be optimized with respect to its impact on the environment and the sustainable development of society.

Around the same period the Gaming and Participatory Simulation Labs (GaPS Labs) was established at KTH to focus on transferring knowledge from the academic ‘invention’ arena to the practical operations field. A first pilot training was performed in August 2012 about using LCA in procurement of roads in which all relevant Swedish stakeholders were included. From the pilot it became very clear that innovation in complex organizations such as the transport infrastructure sector does not simply dif-

fuse by itself into practise. But a consorted training of operational people to establish a change of mind set and to identify the bottlenecks that will emerge in practise *before* applying innovation is needed.

The GIMI Vision

Combining the industry views from the Road2Science discussions with the Transport and Materials Platform cross-disciplinary ideas and the Participatory Simulation pilot, the GIMI vision started to emerge.

When Vinnova in 2012 came out with their Strategic Innovation Agendas call, Road2Science took the initiative to start developing the GIMI idea further, approaching additional partners and develop a common proposal. In October 2012 Road2Science then started organizing a series of strategy meetings, in which various stakeholders expressed their perception of GREEN and how this could effectively be embedded inside their daily engineering practise.

In the fall of 2012 the submitted GIMI proposal to Vinnova was granted and Road2Science started organizing meetings with the individual partners to discuss their interests, roles and contributions in the GIMI National Innovation Agenda.

Joining GREEN forces

Through several information meetings, the concept behind the National Innovation Agendas crystalized itself further and the GIMI visionaries started developing the GIMI Road Map. While doing so, they identified partner agendas that were developing a shared vision and that could have common activities between agendas and thus benefit from each other's environment.

During winter 2012-2013 several meetings and Workshops were organized between GIMI and other relevant innovation agendas. In these meetings, focus was placed on identifying the common goals and activities where the 1+1>2 principle would apply. The differences in focus and relevant stakeholders of the agendas were also discussed in detail.

From these meetings it was concluded that it is important for GIMI to keep its own focus, to not loose momentum and identify the 'side-paths' which could be shared with other agendas to optimise each other's momentum, share infrastructure and knowledge and have a larger collective impact. Specifically, a number of activities regarding the aggregates production in the ***MinBas*** agenda, using building information technology for transport infrastructure in the ***ICT-BIM*** agenda and developing future scenarios to diminish CO2 usage in transport related activities in the ***Nationell Kraftsamling för Transportrelaterad verksamhet till år 2050***' agenda were identified as important collaboration paths.

A national effort

The GIMI vision is very ambitious, challenging and exciting. The societal impact that this agenda could have is reaching beyond optimization of a number of processes, tools or products. GIMI is about establishing a mind-set change in Sweden. At this moment in time Sweden has the in-house expertise and infrastructure capacity to be successfully creating GIMInnovations, implementing them into practise and making them into Swedish export products.

As a nation, Sweden is small enough that the agenda can unite all its stakeholders into a common vision, and large and innovation-driven enough that its impact will be significant. The current situation of the international transport infrastructure sector is such that if Sweden embraces the GIMI agenda today, we will become a front-running nation in Green Infrastructure Material Innovations tomorrow and, as such, have the opportunity to set the agenda globally.

'The GIMI National Innovation Agenda will transform Sweden into a global frontrunner in GIMInnovations'

Appendix 1: CVs of keymembers

(...and what their role will be in GIMI?)

Name: Nicole Kringos
Date of birth: 1979
Nationality: Dutch
Affiliation: Associate Professor Highway and Railway Engineering, KTH
Scientific Director KTH Road2Science Center
Vice-Chair Transport Science Department
Email: Kringos@kth.se

GIMI role: GIMI Coordinator

Name: Staffan Hintze
Date of birth: 1958
Nationality: Swedish
Affiliation: NCC, Senior Vice President, R&D, NCC Construction Sweden AB.
Email: staffan.hintze@ncc.se

GIMI role: SSE-1: Open Platform Coordinator

Name: Johan Dozzi
Date of birth: 1969
Nationality: Swedish
Affiliation: President of Sweco Infrastructure, Sweco AB
Email: johan.dozzi@sweco.se

GIMI role: SSE-2: GIMI COOP Program Coordinator

Name: Per Redelius
Date of birth: 1948
Nationality: Swedish
Affiliation: Nynas, Group Research Manager for both Bitumen and Naphthenics
Email: per.redelius@nynas.com

GIMI role: SSE-3: GIMI AIM Days Coordinator

Name: Bjorn Birgisson
Date of birth: 1963
Nationality: Icelandic
Affiliation: KTH, Vice President of Research
Chair KTH Transport Platform
Email: bjornbir@kth.se

GIMI role: SSE-4: GIMI Research Program Coordinator

Name: Magnus Bergendal
Date of birth: 1961
Nationality: Swedish
Affiliation: PEAB, head Northern Infrastructure
Email: Magnus.Bergendal@peab.se

GIMI role: SSE-5: GIMI Online Course Program

Name: Anna Furness-Linden
Date of birth: 1978
Nationality: Swedish
Affiliation: SIS, Swedish Standards Institute, Business Development
SIS representative in European executive network for standardization, innovation and research (STAIR)
Email: anna.furness-linden@sis.se

GIMI role: SSE-6: GIMI Standardization Coordinator

Name: Sebastiaan Meijer
Date of birth: 1979
Nationality: Dutch
Affiliation: KTH, associate professor transport systems,
Director Gaming and Participatory Simulation Laboratories
Email: smeijer@kth.se

GIMI role: SSE-7: GIMI PS Training Coordinator

Name: Ulf Håkansson
Date of birth: 1958
Nationality: Swedish
Affiliation: Vice-President Skanska Risk Management
Email: ulf.hakansson@skanska.se

GIMI role: SSE-8: GIMI Strategic Partnerships Coordinator

Name: Anna Nilsson Ehle
Date of birth: 1951
Nationality: Swedish
Affiliation: Chalmers, Director SAFER - Vehicle and Traffic Safety Centre
Email: anna.nilsson-ehle@chalmers.se

GIMI role: SSE-9 GIMI Demonstrations Coordinator

Name: Mårten Lindström
Date of birth: 1950
Nationality: Swedish
Affiliation: IQ Samhällsbyggnad, Vice-Chairman of the Board
Managing director Samhällsbyggnadslänken, KTH
Email: marten.lindstrom@more10ab.se

GIMI role: SSE-10: GIMI Dissemination & Exploitation

Name: Ulf Karlsson
Date of birth: 1957
Nationality: Swedish
Affiliation: KTH, Director Materials Platform
Professor Material Physics, KTH
Email: ulfka@kth.se

GIMI role: Member of GIMI National Reference Group

Name: Per Andersson
Date of birth: 1956
Nationality: Swedish
Affiliation: Trafikverket, Head of Road and Rail Division, Swedish, Department of Technology and Environment.
Email: per.andersson@trafikverket.se

GIMI role: Member of GIMI National Reference Group

Name: Per Muren
Date of birth: 1948
Nationality: Swedish
Affiliation: NCC Roads, senior advisor
Email: per.muren@ncc.se

GIMI role: Member of GIMI National Reference Group
Coordinator MinBas Strategic Innovation Agenda

Name: Daniel Hagberg
Date of birth: 1977
Nationality: Swedish
Affiliation: AkzoNobel Surface Chemistry, Global Project Manager
Email: Daniel.Hagberg@akzonobel.com

GIMI role: Member of GIMI National Reference Group

Name: Curt Linder
Date of birth: 1951
Nationality: Swedish
Affiliation: SIS, Swedish Standards Institute, project manager building and construction
Email: curt.linder@sis.se

GIMI role: Member of GIMI National Reference Group

Name: Per-Erik Petersson
Date of birth: 1949
Nationality: Swedish
Affiliation: SP Technical Research Institute of Sweden, Chief Technology Officer
Email: pererik.petersson@sp.se

GIMI role: Member of GIMI National Reference Group

Name: Mikael Nybacka
Date of birth: 1979
Nationality: Swedish
Affiliation: Assistant Professor Vehicle Dynamics
Deputy Director KTH Transport Platform

GIMI role: Member of GIMI National Reference Group

Appendix 2: Overview of GIMI Key Performance Indicators

(...and what will they be measuring?)

Table 3: Overview of GIMI Key Performance Indicators

KPI-1: GIMI graduates	
Measuring the attractiveness of GIMI and its ability of creating a new generation of GIMI engineers	KPI-1.1: number of students in the environment
	KPI-1.2: number of GIMI scholarships awarded
	KPI-1.3: number of 'mid career' GIMI professionals retained
	KPI-1.4: number of new GIMI graduates
	KPI-1.5: number of 'students' inserted in the labour market in the GIMI environment
	KPI-1.6: first salary when entering labour market
KPI-2: GIMI publications	
Measuring the level of GIMI dissemination in the academic, public and privat sector	KPI-2.1: Number of GIMI scientific journal publications
	KPI-2.2: Number of GIMI conference publications
	KPI-2.3: Number of GIMI licentiate theses published
	KPI-2.4: Number of GIMI PhD theses published
	KPI-2.5: Number of GIMI popular media publications
	KPI-2.6: Number of GIMI articles in newsletters or magazines of related branches
KPI-3: GIMI ventures	
Measuring how fertile and creative the GIMI environment is	KPI-3.1: Number of formalized commitments established between GIMI and entrepreneurs
	KPI-3.2: Number of GIMI start-ups created
KPI-4: GIMI growth into existing industries	
Measuring the transfer of GIMI generated knowledge into industries	KPI-4.1: Number of GIMI knowledge adoptions
	KPI-4.2: Number of GIMI knowledge transfers
	KPI-4.3: Number of new or improved products/services/processes that are direct output of a GIMI activity and their TAM values
	KPI-4.4: The number of improved products/services/processes adapted with GIMI technology
	KPI-4.5: Number of industries/institutes/governmental agencies adopting GIMI innovations
KPI-5: GIMI Industries	
Measuring the attractiveness of the GIMI environment for industries	KPI-5.1: Number of industries contributing to the GIMI environment
	KPI-5.2: Input from these industries into the GIMI environment

KPI-6: GIMI SMEs	
Measuring the attractiveness of the GIMI environment for SMEs	KPI-6.1: Number of SMEs contributing to the GIMI environment
	KPI-6.2: Number of SMEs adopting GIMI technology
KPI-7: GIMI Projects	
Measuring the GIMI research activities and stakeholder involvement	KPI-7.1: Number of active GIMI research projects
	KPI-7.2: Number of completed GIMI research projects
	KPI-7.3: Number of GIMI research projects that integrate 2 or more disciplines
	KPI-7.4: Number of GIMI research projects that have 3 or more stakeholders involved
	KPI-7.5: Number of active research projects in the GIMI environment that have SME partners
KPI-8: GIMI Courses	
Measuring the GIMI educational activities and stakeholder involvement	KPI-8.1: Number of GIMI courses given
	KPI-8.2: Number of online GIMI courses given
	KPI-8.3: Number of GIMI completed course certificates granted
	KPI-8.4: Number of GIMI courses given more than once
KPI-9: GIMI Demo's	
Measuring the level of GIMInnovation dissemination	KPI-9.1: Number of GIMI demonstration sites
	KPI-9.2: Number of GIMI demonstration events
	KPI-9.3: Number of events where GIMI is attended & participating
KPI-10: Sector change	
Measuring the GIMI anchoring in society	KPI-10.1: Number of GIMI Open Platform Users
	KPI-10.2: Number of GIMI Academy-Industry Meeting days organized
	KPI-10.3: Number of GIMI FRAME GAMES developed
	KPI-10.4: GIMI member annual feedback
KPI-11: Standardization	
Measuring the GIMI induced policy changes	KPI-11.1: Number of GIMI members in Standardization Committees
	KPI-11.2: Number of GIMI standards developed
	KPI-11.3: Number of projects in which the GIMI standards were utilized

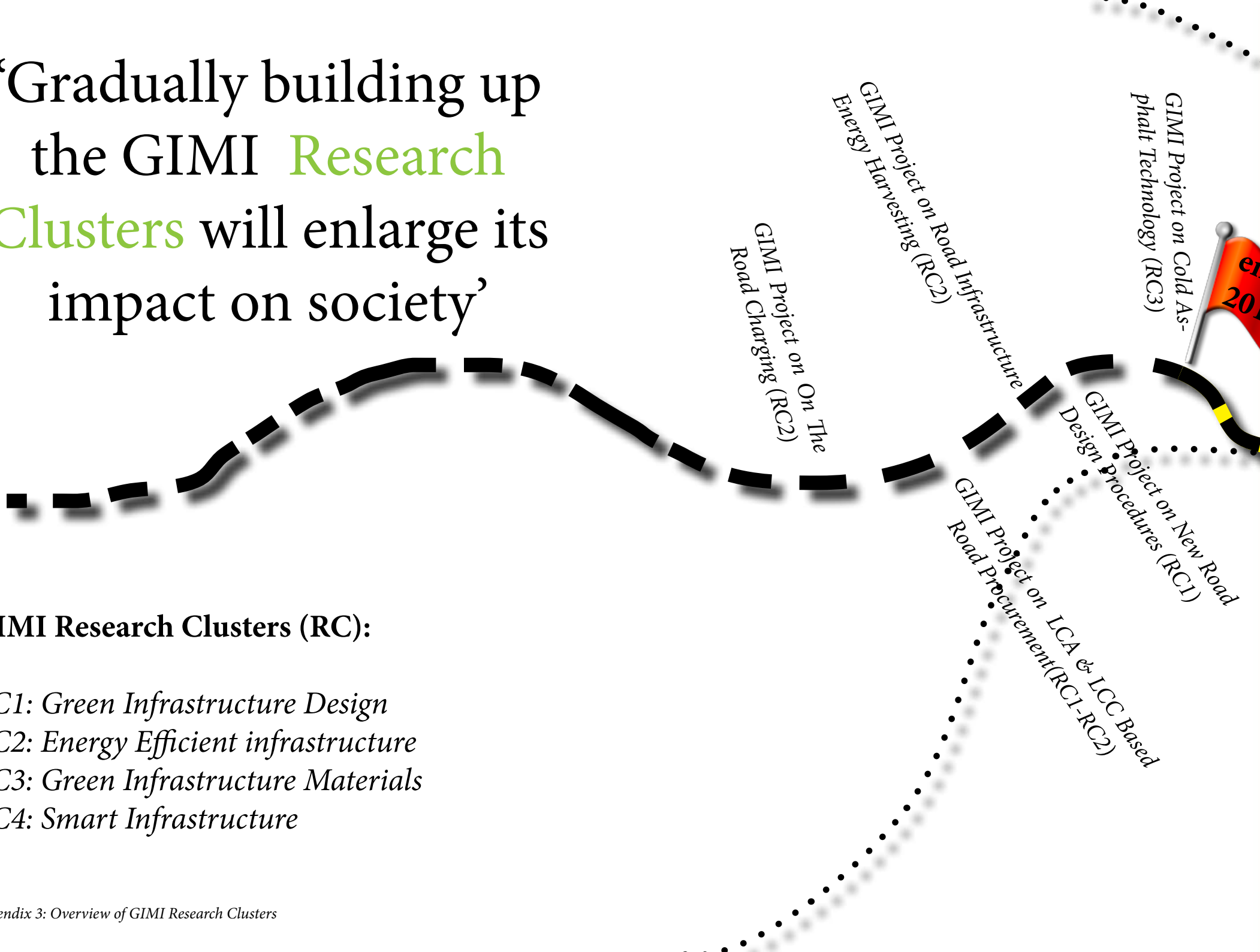
Table 3 (continued): Overview of GIMI Key Performance Indicators

KPI-12: GIMI revenues	
Measuring the long-term sustainability and anchoring of GIMI	KPI-12.1: Total revenue from monetization
	KPI-12.2 The rate by which the percentage of the government funding vs the total budget decreases
	KPI-12.3: The relative increase of donations in current year against last year
	KPI-12.4: Relative increase of total budget in current year against last year
KPI-13: GIMI awards	
Measuring the level of visibility and recognition of GIMInnovations	KPI-13.1: The number of awards given to the GIMI environment and the GIMI partners
KPI-14: GIMI's international presence	
Measuring the level of international dissemination and anchoring of GIMInnovations	KPI-12.1: Number of international students active in the GIMI environment
	KPI-12.2: Number of GIMI publications with 1 or more international author
	KPI-12.3: Number of formalized GIMI commitments between Swedish and international parties
	KPI-12.4: Number of GIMI knowledge adoptions, tranfers or innovations that are accepted by an international party.
	KPI-12.5: Number of international entities that are active in the GIMI environment.
	KPI-12.6: Number of GIMI projects that have 1 or more international partner(s)
	KPI-12.7: Number of international GIMI demonstration sites
	KPI-12.8: Number of GIMI members in International Standardization Committees
	KPI-12.9: Amount of GIMI revenue originating from international activities
	KPI-12.10: Amount of international GIMI awards

Appendix 3: Overview of GIMI Research Clusters

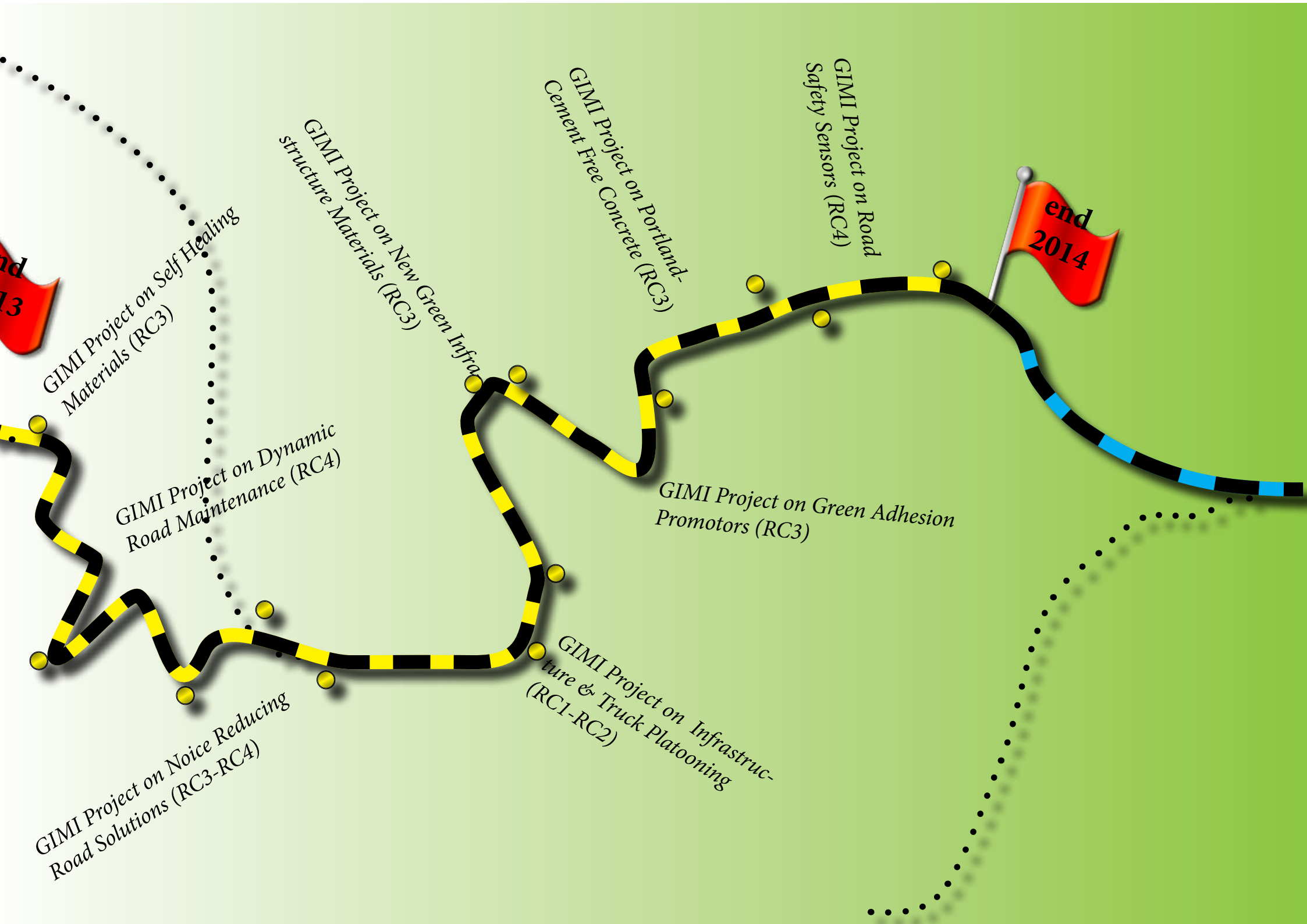
(...and what innovations will come from them?)

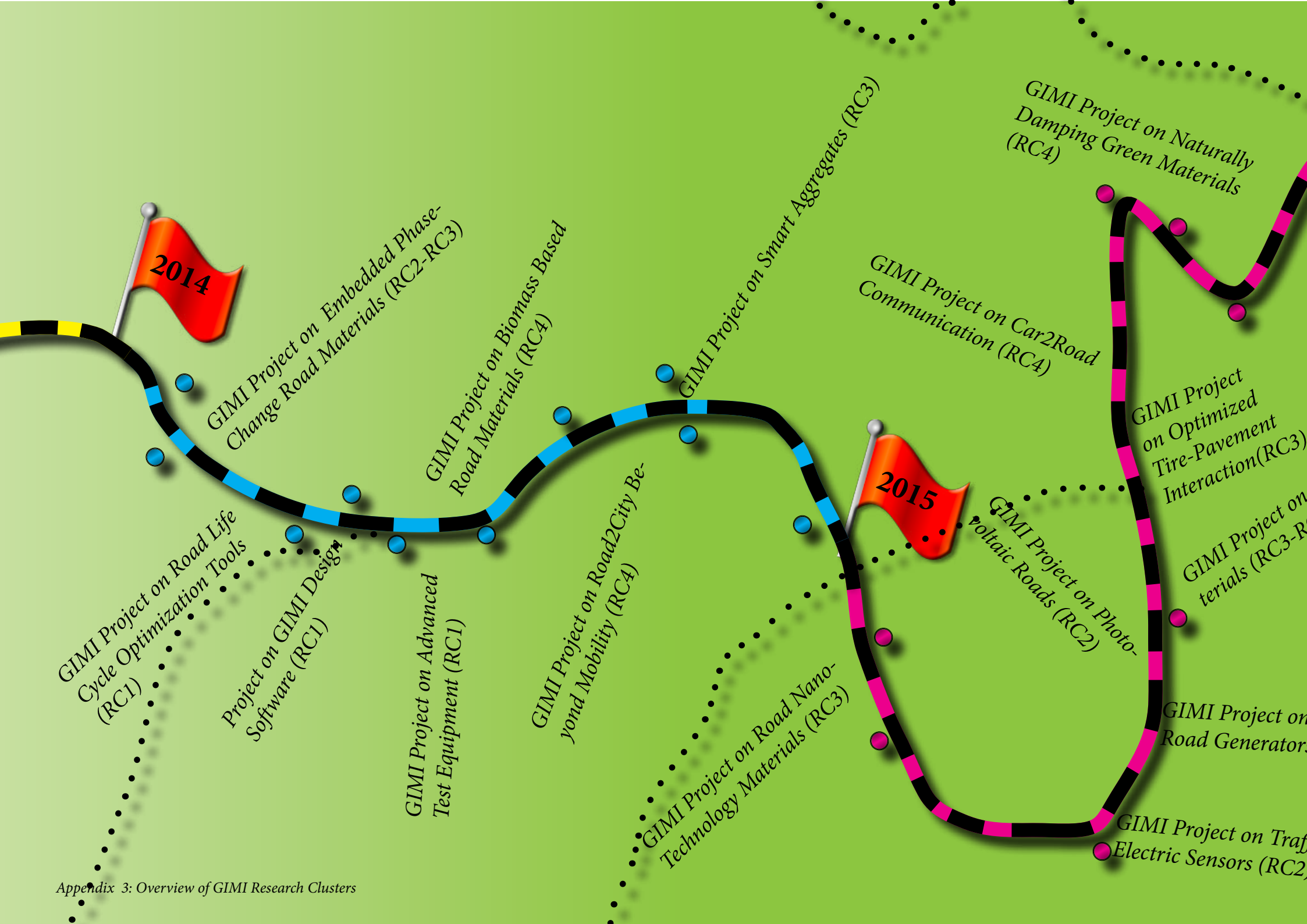
‘Gradually building up the GIMI Research Clusters will enlarge its impact on society’



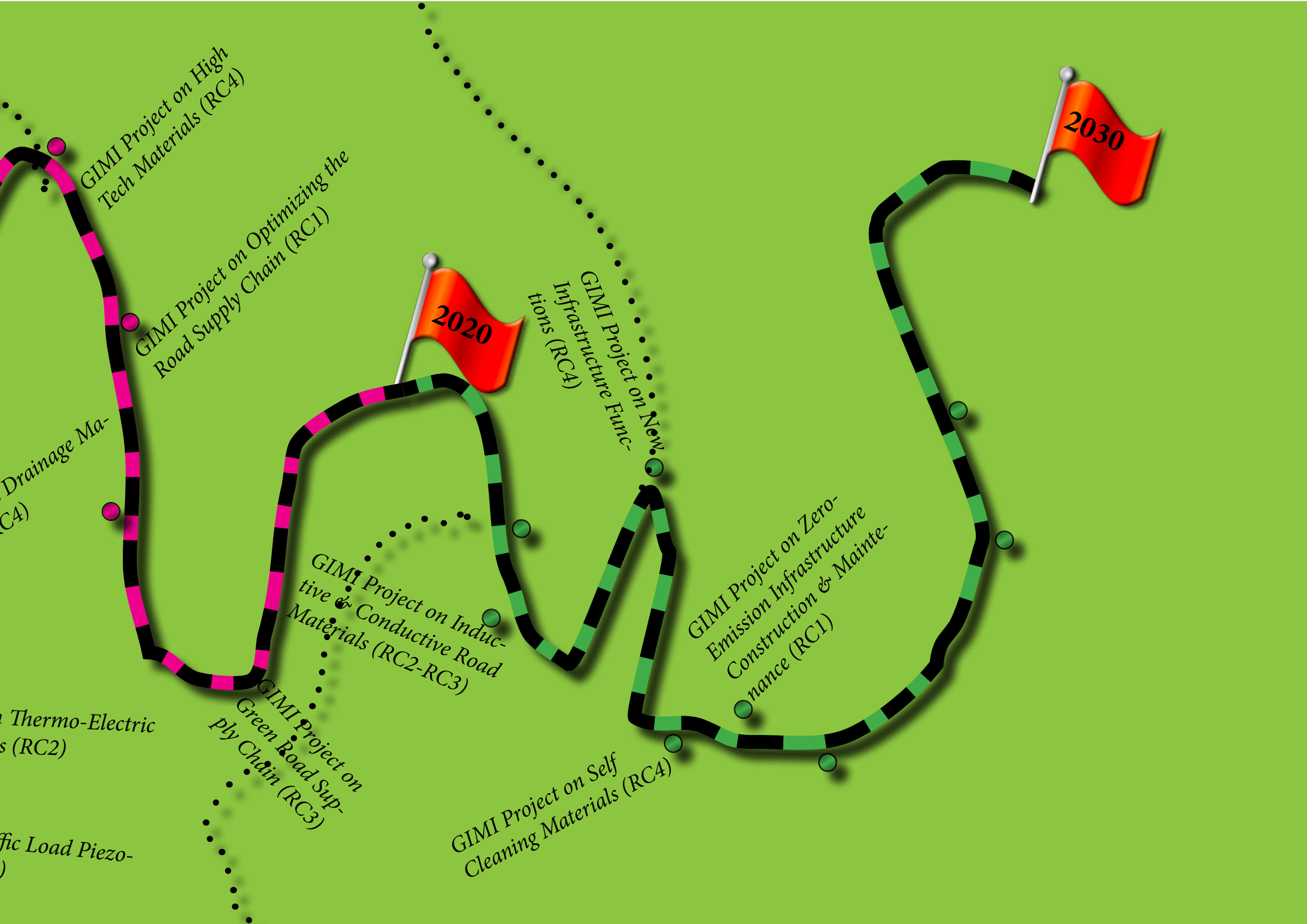
GIMI Research Clusters (RC):

RC1: Green Infrastructure Design
RC2: Energy Efficient infrastructure
RC3: Green Infrastructure Materials
RC4: Smart Infrastructure

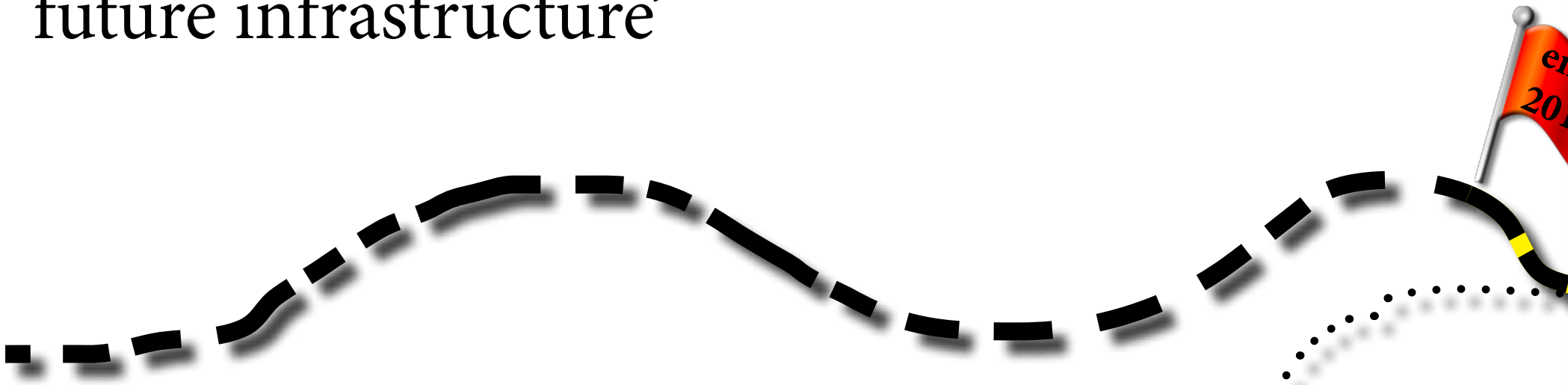

nd
13
GIMI Project on Self Healing Materials (RC3)
GIMI Project on New Green Infra-structure Materials (RC3)
GIMI Project on Portland-Cement Free Concrete (RC3)
GIMI Project on Road Safety Sensors (RC4)
end
2014
GIMI Project on Dynamic Road Maintenance (RC4)
GIMI Project on Green Adhesion Promotors (RC3)
GIMI Project on Noice Reducing Road Solutions (RC3-RC4)
GIMI Project on Infrastruc-ture & Truck Platooning (RC1-RC2)



Appendix 3: Overview of GIMI Research Clusters


GIMI Project on High Tech Materials (RC4)
GIMI Project on Optimizing the Road Supply Chain (RC1)
2020
GIMI Project on New Infrastructure Functions (RC4)
2030
GIMI Project on Inductive & Conductive Road Materials (RC2-RC3)
GIMI Project on Green Road Supply Chain (RC3)
GIMI Project on Zero-Emission Infrastructure Construction & Maintenance (RC1)
GIMI Project on Self Cleaning Materials (RC4)

‘The GIMInnovations will radically change our future infrastructure’

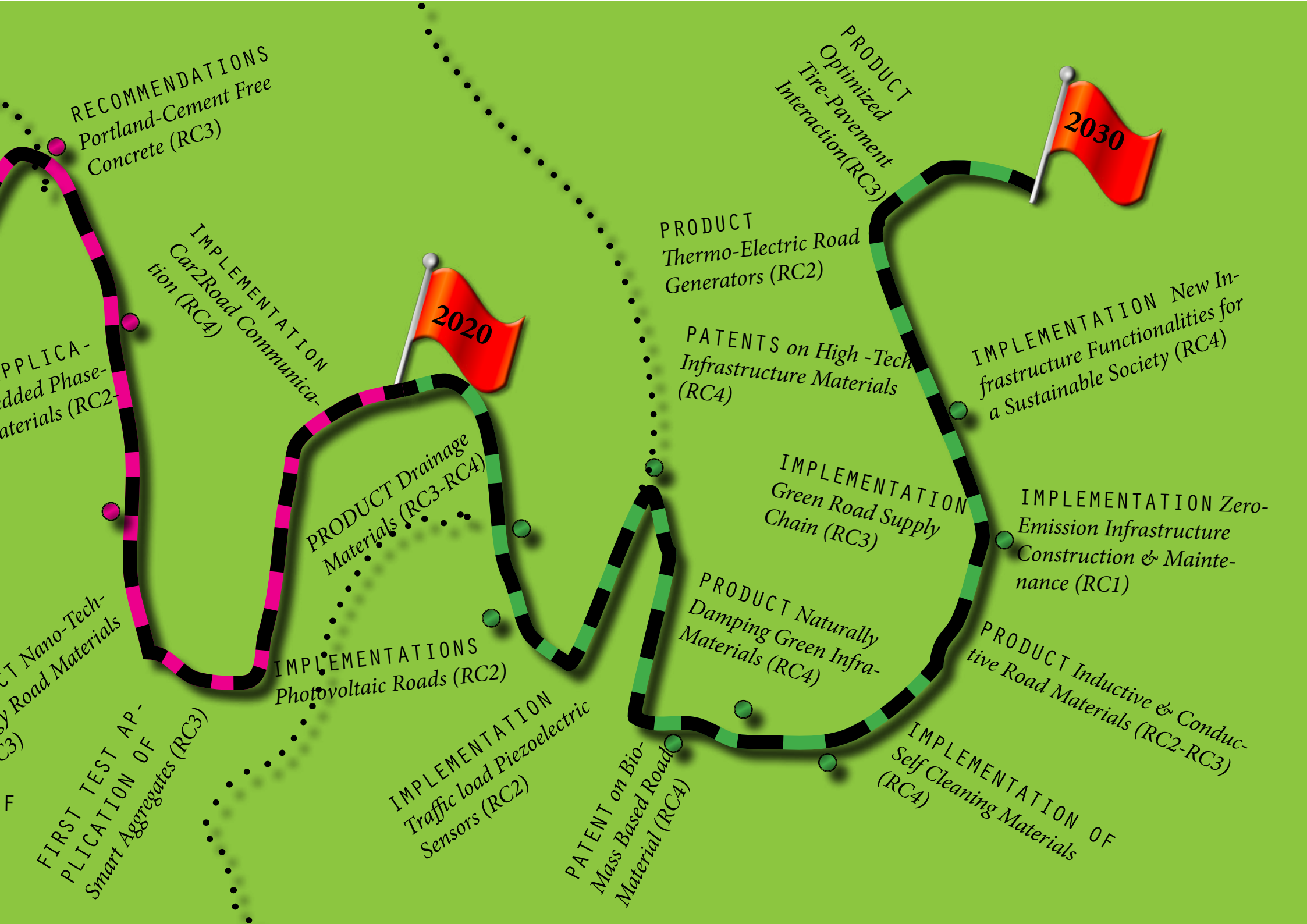


GIMI Research Clusters (RC):

RC1: Green Infrastructure Design
RC2: Energy Efficient infrastructure
RC3: Green Infrastructure Materials
RC4: Smart Infrastructure

nd
13
RECOMMENDATIONS FOR
Road Infrastructure Energy Harvesting (RC2)
FIRST IMPLEMENTATION
OF GIMI Road Design Procedures
(RC1)
FIELD TESTING OF
Cold Asphalt Technology
(RC3)
end
2014
DEMONSTRATION OF
Self Healing Materials (RC3)
FIRST TEST APPLICATION OF
LCA & LCC Based Road Procurement(RC1-RC2)
LARGE SCALE DEMO FOR
On the Road Charging (RC2)

Appendix 3: Overview of GIMI Research Clusters


RECOMMENDATIONS
Portland-Cement Free Concrete (RC3)
PPLICA-
dded Phase-
aterials (RC2-
CT Nano-Tech-
y Road Materials
C3)
F
IMPLEMENTATION
Car2Road Communica-
tion (RC4)
2020
PRODUCT Drainage
Materials (RC3-RC4)
IMPLEMENTATIONS
Photovoltaic Roads (RC2)
FIRST TEST AP-
PLICATION OF
Smart Aggregates (RC3)
IMPLEMENTATION
Traffic load Piezoelectric
Sensors (RC2)
PRODUCT
Thermo-Electric Road
Generators (RC2)
PATENTS on High -Tech
Infrastructure Materials
(RC4)
IMPLEMENTATION
Green Road Supply
Chain (RC3)
PRODUCT Naturally
Damping Green Infra-
Materials (RC4)
PATENT on Bio-
Mass Based Road
Material (RC4)
PRODUCT
Optimized
Tire-Pavement
Interaction(RC3)
2030
IMPLEMENTATION New In-
frastructure Functionalities for
a Sustainable Society (RC4)
IMPLEMENTATION Zero-
Emission Infrastructure
Construction & Mainte-
nance (RC1)
PRODUCT Inductive & Conduc-
tive Road Materials (RC2-RC3)
IMPLEMENTATION OF
Self Cleaning Materials
(RC4)