Model Assessment

	Model name	*Model name*	*Model name*
	Clue-s	**ICLUS**	**I-Places3s**
Benifits and limitations/Strengths and limitations of model			
General strengths and limitations	- Incapability to simulate land-use dynamics in areas without a land-use change history. This is because the model uses empirically-derived relations based on existing land-use patterns for the allocation of land-use change. - Mainly a tool for natural resource management. The built-up areas is seen as only a integrated element in the environment. - Dependent on major statistical regression analysis prior to model run (one for each land-use type = apx. 40) - Reclass of present land-use data is difficult. The final result is highly sensitive to this process. - One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas. + Model is suitable for scenario analysis and the simulation of trajectories of land-use change. + Able to show local effects of regional change + Planning policies are reflected as weighting of physical location factors for suitability (but otherwise loose connection to policies)	- Future urban growth are allocated in response to the spatial pattern of previous growth (trend), which limits the potential for scenario testing. - Require travel-time data from exogenous transport model - Existing model uses pre-defined scenarios. It is unclear if these can be modified - Tight connection to the USA, never been used outside USA - Questionable realism: Allocation mechanism generally generates radial growth patterns of urban land - Main focus of evaluation variables are on climate change impacts of population growth + Unlike the majority of land use change models focusing on urban growth, ICLUS uses and models a full continuum of housing density, from urban to rural + Relatively few assumptions underlying the model	- Theoretical content is fairly limited, beyond basic approach to scenario planning - Default indicators may be incorrect for a different study area - Dependent on exogenous transport model for input and evaluation of output data - Economic reality testing is limited - Model home-page (host) is currently inaccessible! + Effective scenario planning tool for community engagement in which professional planners and citizens work together to analyze and shape the long-term future of their communities. + Little technical skill required + Does not require high-end hardware or expensive license + Extensive set of indicators to evaluate alternative scenarios
Software	Own developed software could mean a high step-in effort for learning the new software	ArcGIS based facilitates implementation, since the software is the most wide spread GIS-system in the world. Model is implemented in a standard ArcMap-document (Mxd).	Web-based software facilitates implementation (but model home-page is currently inaccessible.
User friendliness/Ease of use	**Moderate** Preparation phase is extensive Handling of model after setup is relatively easy Graphical User Interface (GUI) facilitates handling of model	**High** Existing model (USA-case) is relatively easy to handle since it is incorporated in the ArcGIS-software.	**Low** Preparation phase is extensive Handling of model after setup is relatively complex Graphical User Interface (GUI) facilitates handling of model
Quality of user manual/support	**Acceptable** The lack of technical support is a identified risk	**Good**	**Excellent** The lack of technical support is a identified risk
Theoretical and practical complexity	**Complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.	**Complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.	**Complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.
Transparency (Can the planning profession understand how to apply this tool?)	**Acceptable**	**Acceptable**	**High**
Evaluation capabilities/Ability to compare scenarios	**Good**	**Good** (existing model for the USA)	**Good**
Model flexibility	**Low** Model modules cannot be run separately	**Low** Model modules cannot be run separately	**Low**
Generality (Ability of model to be transferred to other environments)	**Low** Theoretical framework is universal. Model needs new data calibration (statistical regression analysis) for each new study area, which is a major task.	**Low** Model is tightly connected to the USA. Unclear if model can be transffered to other study areas.	**High** Theoretical framework is universal. Model is devloped so it can be transferred to other study areas.

Model Assessment

	Data need (availability and quality)	**Moderate** Historical data of land-use change (satellite images) is needed for calibration of model. This might be difficult to come over.	**Moderate** Historical data of land-use change (satellite images) is needed for calibration of model. This might be difficult to come over.	**High** Data hungry model. Based on data availability and definitions in the USA. Might be problematic if model is transferred to other study area.
	Data preparation for model setup	**High** Dependent on major statistical regression analysis prior to model run for model calibration/validation	**High** (If implemented in other study area)	**High**
	Computational performance needed	**Low**	**Low**	**Low** (Can be run on standard computer)
	Communicability and ability for understanding model input-output for non technical experts (e.g. public participation)	**Low** Planning participation and policy testing can be facilitated in the suitability part och allocation module, but otherwise the model is an expert tool. Graphical output of policy impact can be interpreted qualitative by the public, but not in an interactive way.	**High** (Based on the existing model for the USA)	**High** Does not require high-end hardware or expensive license for user in workshops. Proven ability for community engagement (in the USA).
	Relevance of the model in a Nordic planning perspective	**Low** Theoretical framework and mode approach is relevant for the planning system in the Nordic Countries, but the model relies heavily on historical land use trends and has a weak connection to planning policies for scenario testing of the built-up environment. Has not been used in the Nordic countries.	**Unclear**	**Unclear** Model assumptions are mainly based on conditions in the USA. More of a economic market-driven allocation model than a planning model.
	Initial effort of model implementation	**High** Data collection, Data preparation, and completion of one scenario woult typically take 3-4 months. Statistical regression analysis prior to model run for calibration/validation is a major task.	**Unclear**	**High** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 3-4 months.
	Operating costs (€) **(Own staff)**	**High** Model license: Free Model setup: Appx. 40-60 000 Per scenario: Appx. 10-20 000 Expertise team needed for model setup and operation would typically consist of a planner, GIS-technician and a statistician	**High** (If implemented in other study area) Model license: Free Model setup: Appx. 30-40 000 Per scenario: Appx. 5-10 000 Expertise team needed for model setup and operation would typically consist of a planner, GIS-technician and a demographer	**High** Model license: Free Model setup: Appx. 30-40 000 Per scenario: Appx. 15-20 000 Expertise team needed for model setup and operation would typically consist of a planner, GIS-technician and a statistician
	Maintenance cost (€)	**Moderate**	**Low**	**Low**
	Training costs (€)	**Moderate** Appx. 10 000 (based on two persons)	**Low**	**High** Appx. 20 000 (based on two persons)
	Organization stability	**Moderate** Model is highly dependent on the ongoing development and maintainance perseverance of Wageningen University (NL) (Model has been maintained during the past 17 years.)	**High** Model is maintained by the United States Environmental Protection Agency (EPA), which probably ensures good stability.	**Low** Model home-page (host) is currently inaccessible.
		Clue-s	**ICLUS**	**I-Places3s**
		Model name	*Model name*	*Model name*

	Model name	*Model name*	*Model name*
	IPM	**Land Change Modeler**	**Land-Use Scanner**
Benifits and limitations/Strengths and limitations of model			
General strengths and limitations	- Limited number of time-steps - Would preferably be connected to a transport model (for local accessibility as input to suitability and evaluation of allocation effectiveness according to scenario - Economic reality testing is limited - Simple underlying assumtions - Important data for allocation potential ("how much") in each area is the densification potential, which needs to be pre-computed based on detailed building data (floorspace/ha) - No graphical interface within model + Detailed graphical output of future land-use (densities) + Unlike most models, IPM handles densification of already built up areas, which is an important part of smart/green urban growth since it limits the demand for undeveloped land + Many evaluation possibilities connected to land consumption (allocation efficiency, total land demand, loss of green areas etc.) and (if connected to transport model) transport impact of different planning/location policies + Relatively easy to set up if data is available + Scenario descriptions of alternative land-use policies, investments decisions, growth trends can be simulated, analyzed and compared for regional importance.	- Only models one single time-step - Dependent on historical land use change and forecasts the historical trend into the future - Main focus is on natural environment, urban areas is seen as an integrated part of the natural system - Few examples from urban growth studies + Detailed graphical output of future land use + Strong theoretical framework for predicting land-use change + Model theory holds for testing at different locations	- One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas. - Dependent on historical land use change patterns - Transfer to other study area require extensive calibration/validation - Implemented in special software, which probably will be a high step-in for new users - Some of the model interface is in Dutch, which might cause some confusion + Widely used around the world, many case studies are documented + Seems to be a relevant model as a planning support system and for policy testing + Driven by exogenous regional forecasts on population and employment + Overall theoretical model framework and model steps is logic and easy to follow
Software	Arc-GIS based facilitates implementation, since the software is the most wide spread GIS-system in the world. Model is implemented in a standard ArcMap-document (Mxd).	GIS-software IDRISI facilitates implementation, since the software is (or was) one of the most common GIS-softwares in the world. IDRISI is (was) regarded as perticular useful for raster analysis. Module is also available in ArcGIS.	Own devloped software might limit the potential for model
User friendliness/Ease of use	**Moderate** Preparation phase is moderate. Handling of model after setup is relatively easy, but require basic knowledge in programming.	**High** Model incorporated in the IDRISI software or module for ArcGIS.	**Moderate** Graphical User Interface (GUI), but some skills probably needed for handling the model.
Quality of user manual/support	**Low** Technical support (at cost) is available (Model is not a commercial software)	**n.a.** (No technical user manual found)	**Good** (Updated in 2013)
Theoretical and practical complexity	**Simple model structure** Mainly require thorough knowledge in planning concepts, but model mechanism and work flow is realtively easy to follow.	**Unclear**	**Complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.
Transparency (Can the planning profession understand how to apply this tool?)	**High**	**Unclear**	**Acceptable**
Evaluation capabilities/Ability to compare scenarios	**Good**	**Poor** (When it comes to the urban environment)	**Good**
Model flexibility	**Moderate** Stand-alone model, but relies on exogenous forecasts on regional population and employment, and preferably local acceccibility from transport model.	**Unclear**	**Moderate** Stand-alone model, but relies on exogenous forecasts on regional population and employment, and preferably local acceccibility from transport model.
Generality (Ability of model to be transferred to other environments)	**High** Model has been implemented in different regions in Sweden and also internationally.	**High** Model theory holds for testing at different locations. This is probably the biggest advantages of the model	**Unclear** Especially with repect to calibration/validation of new model

Model Assessment

	Data need (availability and quality)	**Moderate** Model can be run with little data, but more data will typically give more flexibility when translating spatial policies into physical factors.	**Moderate** Continous land cover data (satellite images) from two periods are needed for validation of model. Any geographical data can be tested if they hold explanatory power to explain observed patterns of previous land use change.	**High** Continous land cover data (satellite images) from two periods are needed for validation of model. Additional geographical data is needed to drive the model for suitability analysis Each land use class are assumed to have their own suitability, which might require extensive data
	Data preparation for model setup	**Moderate** Translation of spatial policies into physical factors.	**Moderate**	**Moderate**
	Computational performance needed	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)
	Communicability and ability for understanding model input-output for non technical experts (e.g. public participation)	**High** Model is driven by planner descisions (for suitability) and assumptions on densification potentials for different urban land-use types. Model outputs (maps and quantitative indicators) can be communicated for each scenario.	**Moderate** Graphic results can be interpreted by non-experts	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. It can also function as a communication tool between analysts in various policy fields.
	Relevance of the model in a Nordic planning perspective	**High** Model has explicitly been developed to function within a Swedish planning environment (which is similar to the other Nordic countries)	**Low** Can be used to better understand which underlying factors that drives land use change, but as a prediction tool for urban growth in the Nordic countries, the model probably has low relevance.	**High**
	Initial effort of model implementation	**Moderate** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 2-3 months.	**Low** A minimum of data is needed to run the model, but in reality, output quality will gain from many explanatory variables.	**High** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 3-4 months.
	Operating costs (€) **(Own staff)**	**Moderate** Model license: Free Model setup: 25-30 000 Per scenario: 10-15 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician	**Low** Model license: US$ 395 Model setup: Appx. 5-10 000 Per scenario: Appx. 5-10 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician	**High** Model license: Free Model setup: Appx. 40-60 000 Per scenario: Appx. 10-20 000 Expertise team needed for model setup and operation would typically consist of a planner, GIS-technician and a statistician
	Maintenance cost (€)	**Low**	**Low**	**Low**
	Training costs (€)	**Moderate** Appx. 10 000 (based on two persons)	**Low** Appx. 5-10 000	**Moderate** Appx. 10 000 (based on two persons)
	Organization stability	**High** Model is owned by Stockholm County Council (SLL) and maintained by WSP Sweden (since 2006). SLL has a very long tradition of different land-use models (since 1980's)	**High** IDRISI has been on the market for almost 30 years, which probably ensures good stability.	**High** VU University Amsterdam has a long-standing experience in integrated land use modelling, which probably ensures Good stability.
		IPM	**Land Change Modeler**	**Land-Use Scanner**
		Model name	*Model name*	*Model name*

Model Assessment

	Model name	*Model name*	*Model name*
	LEAM	**LUSIS**	**Metronamica**
Benifits and limitations/Strengths and limitations of model			*Note: Metronamica is a newer version of MOLAND, whereas the assessment for METRONAMICA also should be concidered as an assessment for MOLAND*
General strengths and limitations	- Mainly focuses on urban growth on undeveloped land. Densification of already developed land is possible, but it is unclear how the density changes in these areas (densification potential) - Data hungry model. Specific data needs might be a problem when migrating the model to other study areas - Implementation require assistance from developer (at cost) - One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas + Web-based model, which can be publicly accessible in a possible public participation process + Includes multiple scales and sub-systems + produces "what-if" land-use planning scenarios and "so-what" impact evaluations. + Easy to compare scenarios + Very high resolution (30m), which enables loose coupled linking with other models that might operate at a different spatial scale (e.g Transport model TAZ). + Scenario descriptions of alternative land-use policies, investments decisions, growth trends can be simulated, analyzed and compared for regional importance.	- Little information about how model works - Data hungry model. Data requirements are mainly connected to avilable data in the USA. - Future development allocation is dependent of historical land-use change - One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas + Seems to be a user-friendly model + Policy/Planning goal oriented model for planning purposes. + Based on tools that are available in the ArcGIS-software (Model builder)	- One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas - Own developed software (Geonamica) might cause some difficulties for new users - The exploration of future land use is based on historical patterns - A major and difficult task is calibration of model. Parameters and transition rules have to be calibrated by analyzing the past development, comparing the actual land use change between two points in time with the results of a simulation of the same period. - Questionable realism: Allocation mechanism generally generates radial growth patterns of urban land + Model can interactively simulate the impact of a variety of external influences and policy measures on the regional development of a city, region, country + Is a tool for interactive simulation, analysis, visualisation and communication of the integrated effects of potential planning measures from today up until 50 years in the future + Metronamica allows the planner to interactively enter policy and planning measures as well as trend lines for external pressures and scenarios (but allocation mechanism are basically calibrated on historical patterns, see above notion). + Documented and transparent model + A wide range of pre-defined and custom spatial indicators can be calculated on the fly + Metronamica's visual output can be exported to reports or a GIS for further processing
Software	Web-based software facilitates implementation. Each project is given its own model-homepage from devloper. Model engine is embedded within home-page.	Arc-GIS based facilitates implementation, since the software is the most wide spread GIS-system in the world. Model is implemented in a standard ArcMap-document (Mxd).	Own developed software (Geonamica) might cause some difficulties for new users. Dependency of a commercial software is always a risk when investing time, money and comittment in a new model software.
User friendliness/Ease of use	**High** Preparation phase is moderate (and is supported by developer within license) Graphical User Interface (GUI) is easy to understand and follow.	**High** (probably) But difficult to asses based on (non) existing documentation	**Low** Preparation phase is extensive, especially calibration Handling of model after setup is relatively complex Graphical User Interface (GUI) facilitates handling of model
Quality of user manual/support	**Excellent**	**n.a.**	**Excellent**
Theoretical and practical complexity	**Simple model structure** Mainly require thorough knowledge in planning concepts.	**Simple model structure** (probably) But difficult to asses based on (non) existing documentation	**Complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.
Transparency (Can the planning profession understand how to apply this tool?)	**Acceptable**	**Low**	**High** (but complex architecture)
Evaluation capabilities/Ability to compare scenarios	**Good** Several submodules for impact analysis comes with the model.	**Acceptable** (probably)	**Good** Several submodules for impact analysis comes with the model.
Model flexibility	**Moderate** Stand-alone model, but relies on exogenous forecasts on regional population and employment, and preferably local acceccibility from transport model.	**Low**	**Acceptable** Model modules can be run separately, but extensive modification is probably needed if exogenous models are to be used.
Generality (Ability of model to be transferred to other environments)	**High** Model theory holds for testing at different locations. Model has been tested in Stockholm by KTH.	**Unclear**	**High** Model theory holds for testing at different locations, but as mentioned earlier, extensive calibration is required for any new study area.

Model Assessment

	Data need (availability and quality)	**Moderate** Exogenous regional forecasts of population and employment is needed. A basic set of spatial drivers (GIS-layers) is needed, but can be extended to any number of optional drivers according to study area conditions and/or scenario types.	**High** Data hungry model. Based on data availability and definitions in the USA. Might be problematic if model is transferred to other study area.	**Low** The minimum data required for using only the land use model is an initial land use map. In reality, lots of data is needed, e.g. census data about population and jobs plus a transport network. Metronamica has many options to add more data for additional precision.
	Data preparation for model setup	**Moderate** Translation of spatial policies into physical factors. Loading of data is supported by developer within license.	**Moderate**	**High** Dependent on major statistical regression analysis prior to model run for model calibration/validation
	Computational performance needed	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)
	Communicability and ability for understanding model input-output for non technical experts (e.g. public participation)	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. The web-based scenario home page can probably facilitate public participation.	**High** The model structure and work process seems logical and easy to follow	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. It can also function as a communication tool between analysts in various policy fields.
	Relevance of the model in a Nordic planning perspective	**High** Theoretical framework and mode approach is relevant for the planning system in the Nordic Countries	**Moderate** Difficult to assess.	**Moderate** Major issue is that allocation mechanism of future land use is based on historical patterns, which therefore might weaken the planning/policy component.
	Initial effort of model implementation	**Moderate** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 2-3 months.	**Moderate** Difficult to assess.	**High** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 3-4 months.
	Operating costs (€) **(Own staff)**	**Moderate** Model license: 9 000 py Model setup: 25-30 000 Per scenario: 10-15 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician	**Moderate** Model license: Free (comes as CD from developer or in printed edition of "Smart Land-Use Analysis The LUCIS Model" ESRI Press Model setup: 20-25 000 Per scenario: 10-15 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician	**High** Model license: 15 000 (Limited demo-version is available for free) Model setup: 30-40 000 Per scenario: 20-30 000 Expertise team needed for model setup and operation would typically consist of a planner, statistician, demographer and a GIS-technician
	Maintenance cost (€)	**Moderate** USD 1000 per month	**Low**	**Low** Appx. 2 000 py
	Training costs (€)	Moderate Basic training (web-based) is available for Appx. USD 1250 pp	**Moderate**	High Basic training (at site in NL) is available for Appx. 5 000 pp Additional training are probably required for software and testing, Appx. 10 000 pp.
	Organization stability	**Moderate** Model is dependent on the ongoing development and maintainance perseverance of LEAM-group (USA) (Model has been maintained during the past 3 years.)	**Unclear**	**High** RIKS is a research and development organisation that has been active for a long time. They update Metronamica regularly based on the latest scientific and technical developments. New releases are normally provided once or twice a year.
		LEAM	**LUSIS**	**Metronamica**
		Model name	*Model name*	*Model name*

Model Assessment

	Model name	*Model name*	*Model name*
	UPLAN	**URBANSIM**	**What-IF**
Benifits and limitations/Strengths and limitations of model			
General strengths and limitations	- One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas - Cannot handle redevopment, only urban growth - Questionable realism with respect to urban morphology: Allocation mechanism generally generates radial growth patterns of urban land - Major aim for model is to evaluate how different policies conform to existing plans, but this orientation can probably be overcomed - Lack of sophisticated modeling. Weak theoretical foundation. Simple model structure could mean that som market aspects of urban growth patterns are weak + Easy to implement + Simple, and user friendly model + After setup, model can be run by planner with little effort to create scenarios + Can quickly produce graphical and metric output	- Very complex model, not for beginners - Extremely data hungry - Users have had to resort to synthesizing some of the detailed data in some cases - Calibration and validation are complex and time consuming iterative processes - Require advance knowledge of the model software - Output from transport model is needed for travel time calculations (acceccibility) - Limited built-in indicators for impact analysis - Generating new scenarios is not easy to do in the graphical user interface + Considered as a "state of the art model". Probably the "hottest" land use model today. Many implementations. + Model is free + Strong and internally consistent theoretical basis + Model covers several aspects of the complex urban system. Behavioural realism and transparency: Agents and choices are clear to modelers and to stakeholders + Extensive documentation and web site (wiki allowing users to add content) + Substantial and growing user community in the US, Europe, and elsewhere + Well developed Graphical User Interface (GUI) + Open source means that model can be modified by experienced user	- One major limitation is the exclusive state of individual cells, which only can assume one value/class. Therefore, it cannot handle an important aspect of smart/green growth of urban areas, namely densification of already built-up areas - Cannot handle redevopment, only urban growth - Questionable realism with respect to urban morphology: Allocation mechanism generally generates radial growth patterns of urban land - Weak theoretical foundation. Simple model structure could mean that som market aspects of urban growth patterns are weak + Easy to implement + Simple, and user friendly model + After setup, model can be run by planner with little effort to create scenarios + Can quickly produce graphical and metric output
Software	Arc-GIS based facilitates implementation, since the software is the most wide spread GIS-system in the world. Model is implemented in a standard ArcMap-document (Mxd).	Own developed software might cause some difficulties for new users. Dependency of a non standard software is always a risk when investing time, money and comittment in a new model.	Own developed softwaremight cause some difficulties (probably minor) for new users. Dependency of a commercial software is always a risk when investing time, money and comittment in a new model software.
User friendliness/Ease of use	**High** Preparation phase is moderate Graphical User Interface (GUI) is easy to understand and follow.	**Low** Graphical User Interface (GUI) is relatively easy to understand and follow, but very many steps before model can be run.	**High** Preparation phase is moderate Graphical User Interface (GUI) is fairly easy to understand and follow.
Quality of user manual/support	**Good** (Recently updated)	**Excellent** Extensive support is also available from user community at model home page	**Good** (Recently updated)
Theoretical and practical complexity	**Simple model structure**	**Very complex model structure** Require thorough understanding of modelling theory and techniques. Difficult to implement the model without prior experience in advanced spatial analysis.	**Simple model structure**
Transparency (Can the planning profession understand how to apply this tool?)	**High** Planner will be in a familiar environment	**Moderate** Planner can probably not run the tool him/herself, but will be typically dependent of technical model expert. A planner would probably also have a hard time to understand all parts of model.	**High** Planner will be in a familiar environment
Evaluation capabilities/Ability to compare scenarios	**Good** Some submodules for environmental impact analysis comes with the model (e.g. climate), but model output is flexible and can also be assessed with tailor made indicators.	**Good**	**Good**
Model flexibility	**Moderate** Stand-alone model, but relies on exogenous forecasts on regional population and employment, and preferably local acceccibility from transport model.	**High** Flexibility and modularity allows users to adapt and extend the system	**Moderate** Stand-alone model, but relies on exogenous forecasts on regional population and employment, and preferably local acceccibility from transport model.
Generality (Ability of model to be transferred to other environments)	**High** Beacause model is simple, model theory holds for testing at different locations.	**High** Proven by the fact that model has been implemented in many different study areas and countries. Specific data requirements has shown to be a problem when migratrating model to other countries.	**High** Beacause model is simple, model theory holds for testing at different locations.

Model Assessment

	Data need (availability and quality)	**Moderate** Model can be run with little data, but more data will typically give more flexibility when translating spatial policies into physical factors.	**High** Very data hungry model. Based on data availability and definitions in the USA. Might be problematic if model is transferred to other study area.	Moderate Model can be run with little data, but more data will typically give more flexibility when translating spatial policies into physical factors.
	Data preparation for model setup	**Moderate** Translation of spatial policies into physical factors.	**High** (very)	**Moderate** Translation of spatial policies into physical factors.
	Computational performance needed	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)	**Low** (Can be run on standard computer)
	Communicability and ability for understanding model input-output for non technical experts (e.g. public participation)	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. It can also function as a communication tool between analysts in various policy fields.	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. It can also function as a communication tool between analysts in various policy fields.	**High** The model can be used to investigate the implications of macro policies for human settlement and land use patterns. It can also function as a communication tool between analysts in various policy fields.
	Relevance of the model in a Nordic planning perspective	**High** Theoretical framework and mode approach is relevant for the planning system in the Nordic Countries	**Moderate** Model is mainly developed for explaining market behaviour and individual behaviour in the USA. In a country with strong planning tradition (such as in the Nordic countries), this might be an issue.	**High** Theoretical framework and mode approach is relevant for the planning system in the Nordic Countries
	Initial effort of model implementation	**Moderate** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 1-2 months.	**High** Mainly connected to data collection, data preparation and calibration. Data collection, preparation and completion of one scenario would typically take up to one year by an expertise team.	**Moderate** Mainly connected to data collection and data preparation. Data collection, preparation and completion of one scenario would typically take 1-2 months.
	Operating costs (€) **(Own staff)**	**Low** Model license: Free Model setup: Appx. 5-10 000 Per scenario: Appx. 5-10 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician	**High** (very) Model license: Free Model setup: 300-400 000 (based on cases in the USA) Per scenario: 50-75 000 Expertise team needed for model setup and operation would typically consist of a planner, statistician, demographer, model technician and a GIS-technician	**Low** Model license: Licensed, unclear about cost (free demo-version is avialable) Model setup: Appx. 10-15 000 Per scenario: Appx. 5-10 000 Expertise team needed for model setup and operation would typically consist of a planner and a GIS-technician
	Maintenance cost (€)	**Low**	**Moderate**	**Low**
	Training costs (€)	**Low** Appx. 5-10 000	**High** Appx. 100 000 (based on four persons)	**Low** Appx. 5-10 000
	Organization stability	**Unclear** Model is maintained by University of California and has been used since 2007	**High** Large number of users, an active community and open source software probably ensures good stability.	**Unclear** Model is maintained by WhatIF inc. and has been used since 1996. Small company.
		UPLAN	**URBANSIM**	**What-IF**
		Model name	*Model name*	