INSA STRASBOURG GRADUATE SCHOOL OF SCIENCE AND TECHNOLOGY

ARCHITECTS + ENGINEERS

LGECO

Long-run Forecasting of Emerging Technologies with Logistic Models and Growth of Knowledge

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CONTENT

1: Motivation of the work and previous results

2: What are logistic component and logistic models?

3: Growth of knowledge and logistic models ?

4: Future work

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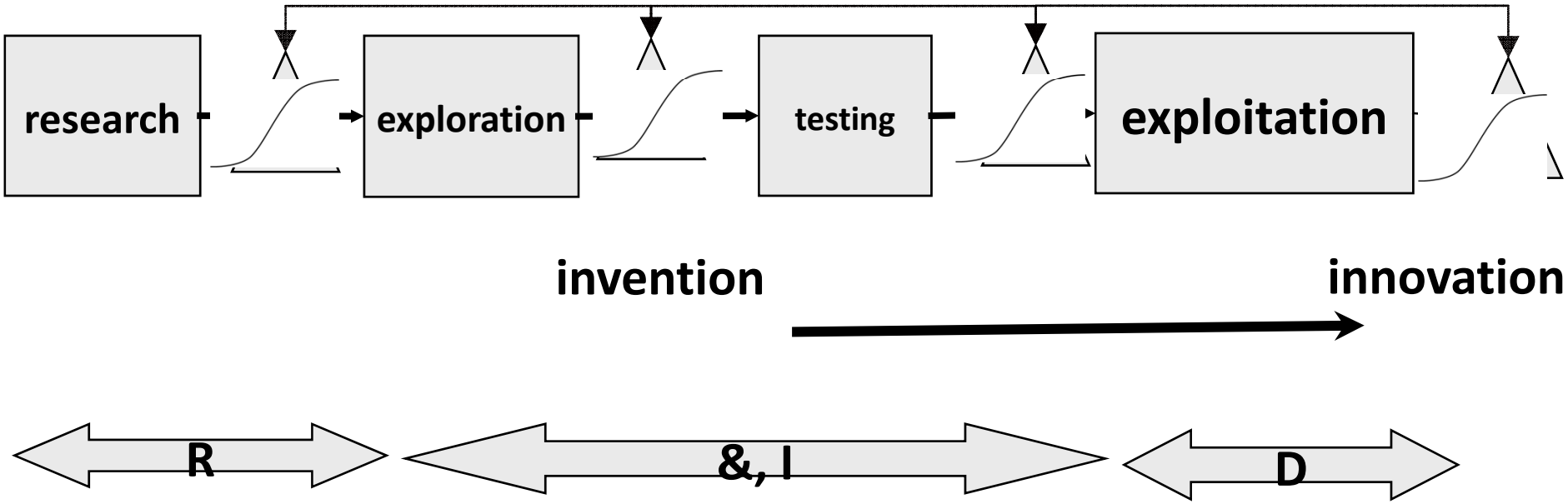
1: Motivations

[invention innovation]



Key:

Knowledge flow

Knowledge production activity

Knowledge stock, storage

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1. Motivations

[Previous work]

- Previous work
  - Qualitative approach
  - Quantitative methods :use of logistic and logistic substitution model with so called naive approach

- Today's presentation

  logistic component model, with a causal approach linking it with the qualitative method (ICED 07).

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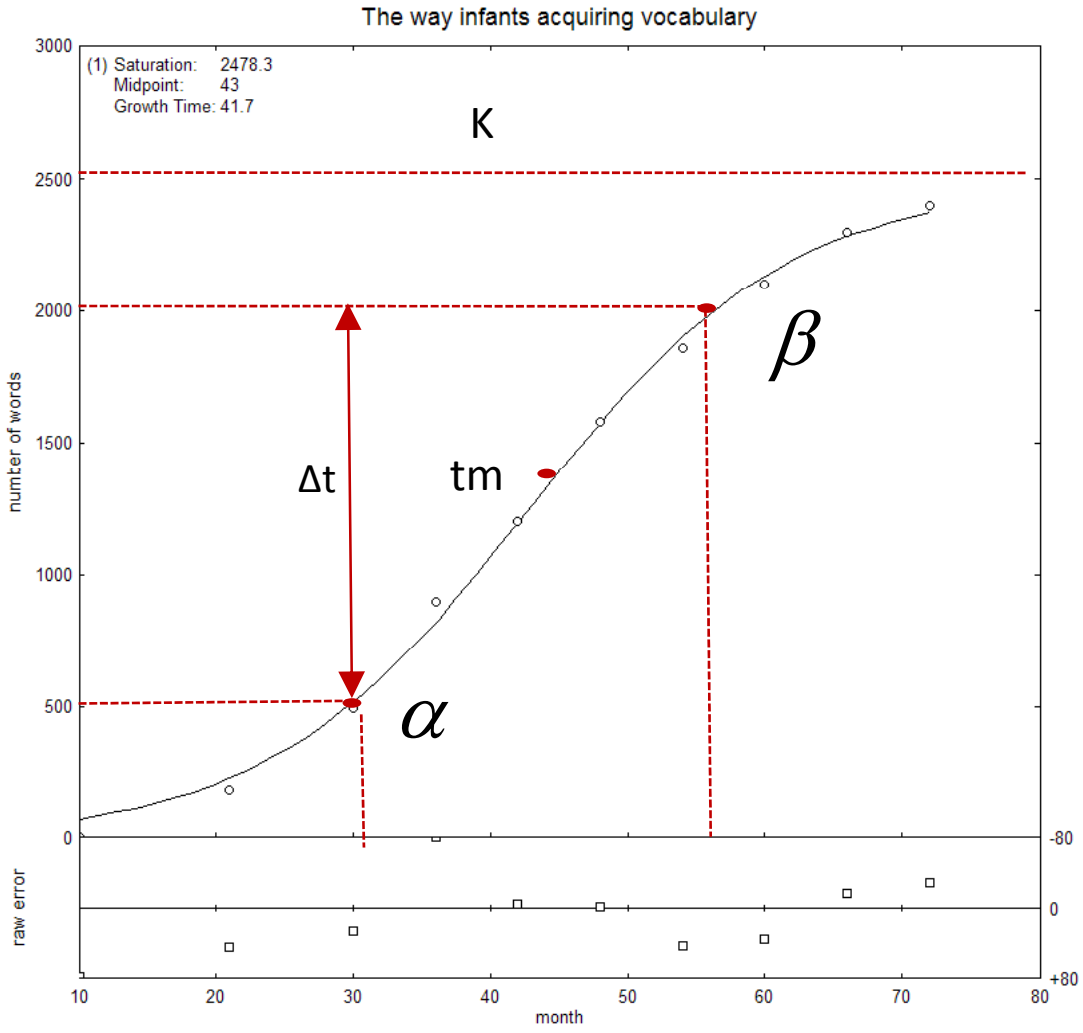
2: Simple logistic (symmetric S-curve)

[introduction: rate of growth, cumulative growth]



$$N(t) = \frac{K}{1 + e^{-\alpha t + \beta}}$$

- K – limit of growth
- tm – midpoint of growth trajectory
- Δt – characteristic duration of growth

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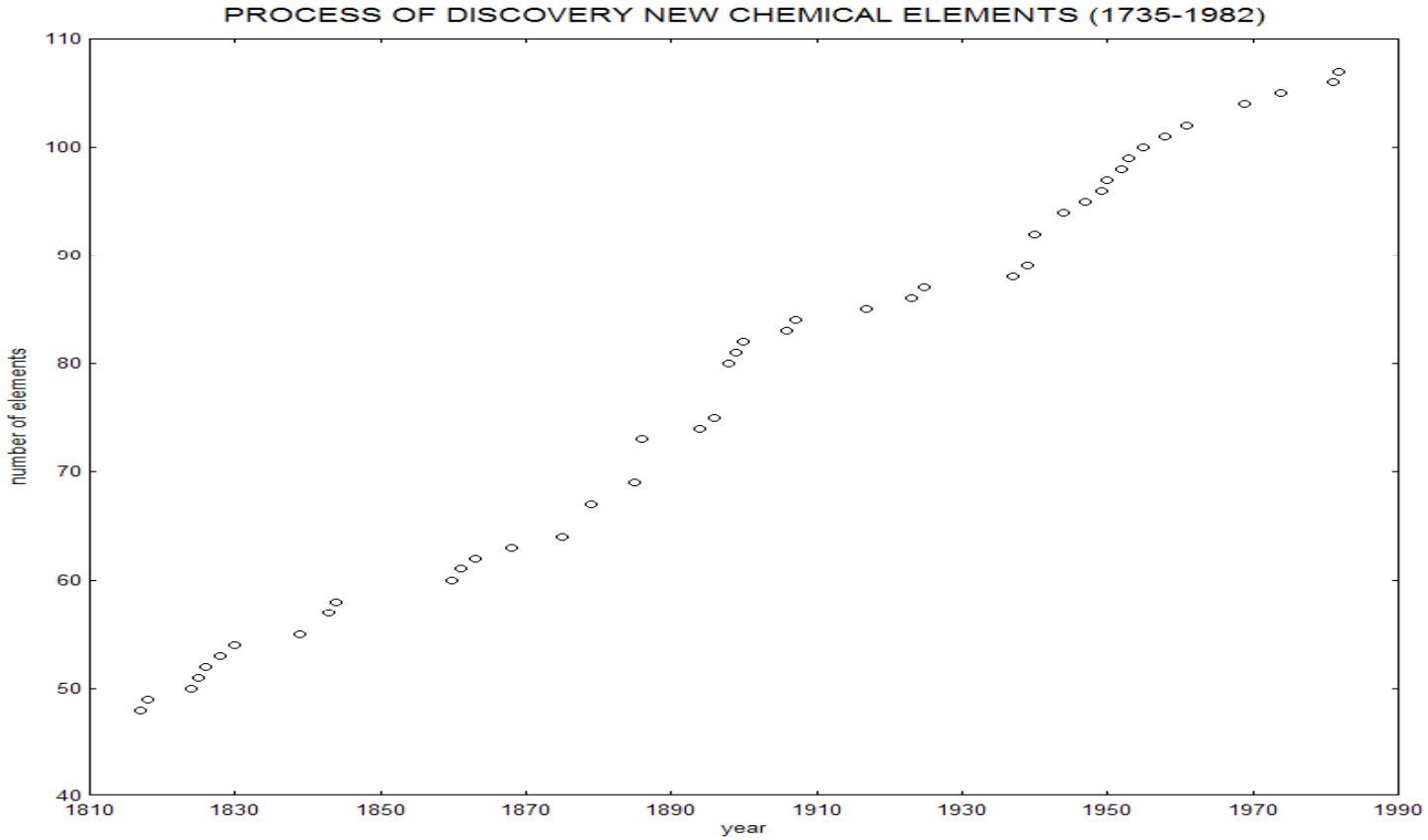
* S-curve fit on data by Loglet Lab Version 1.1.4

2: Logistic model

[Component logistic model]



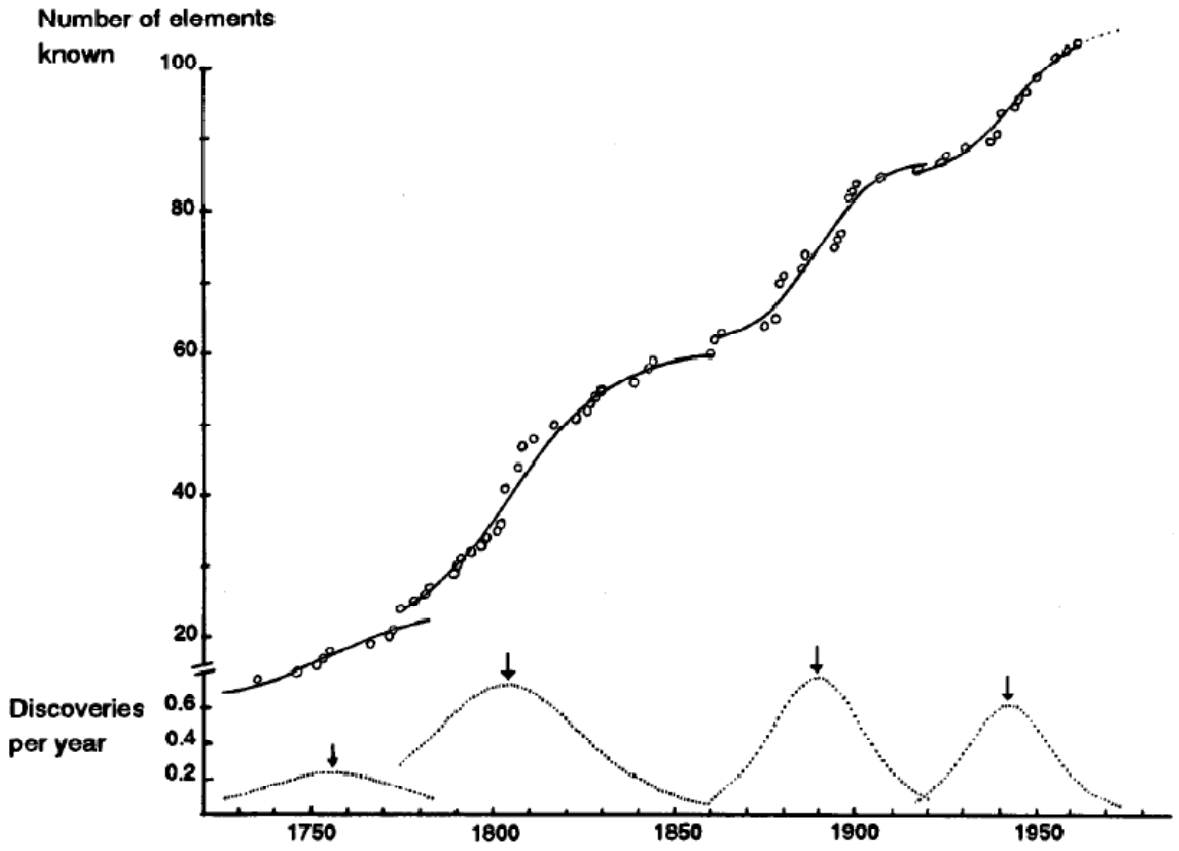
- One or several S curves?

* Source: Modis, T. Predictions - 10 Years Later. (Growth Dynamics, Geneva, Switzerland, 2002), pp. 149. ISBN 2-9700216-1-7.

2: Component logistic model

[the 4 S-curve of this growth process]

THE STABLE ELEMENTS WERE DISCOVERED IN CLUSTERS



* Source: Modis, T. Predictions - 10 Years Later. (Growth Dynamics, Geneva, Switzerland, 2002), pp. 149. ISBN 2-9700216-1-7.

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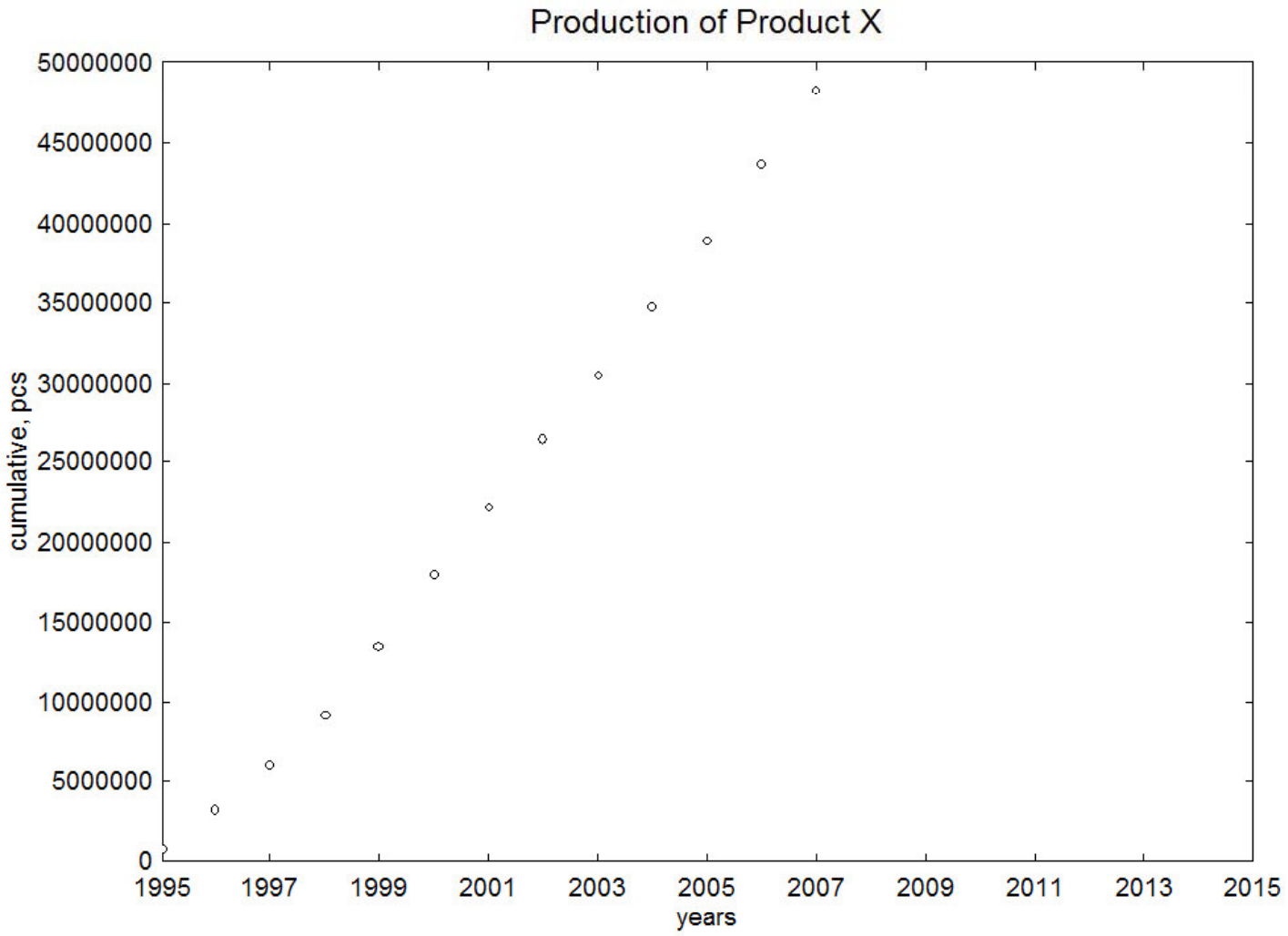
2: Component logistic model

[application in technology forecasting :initial data 1/3]



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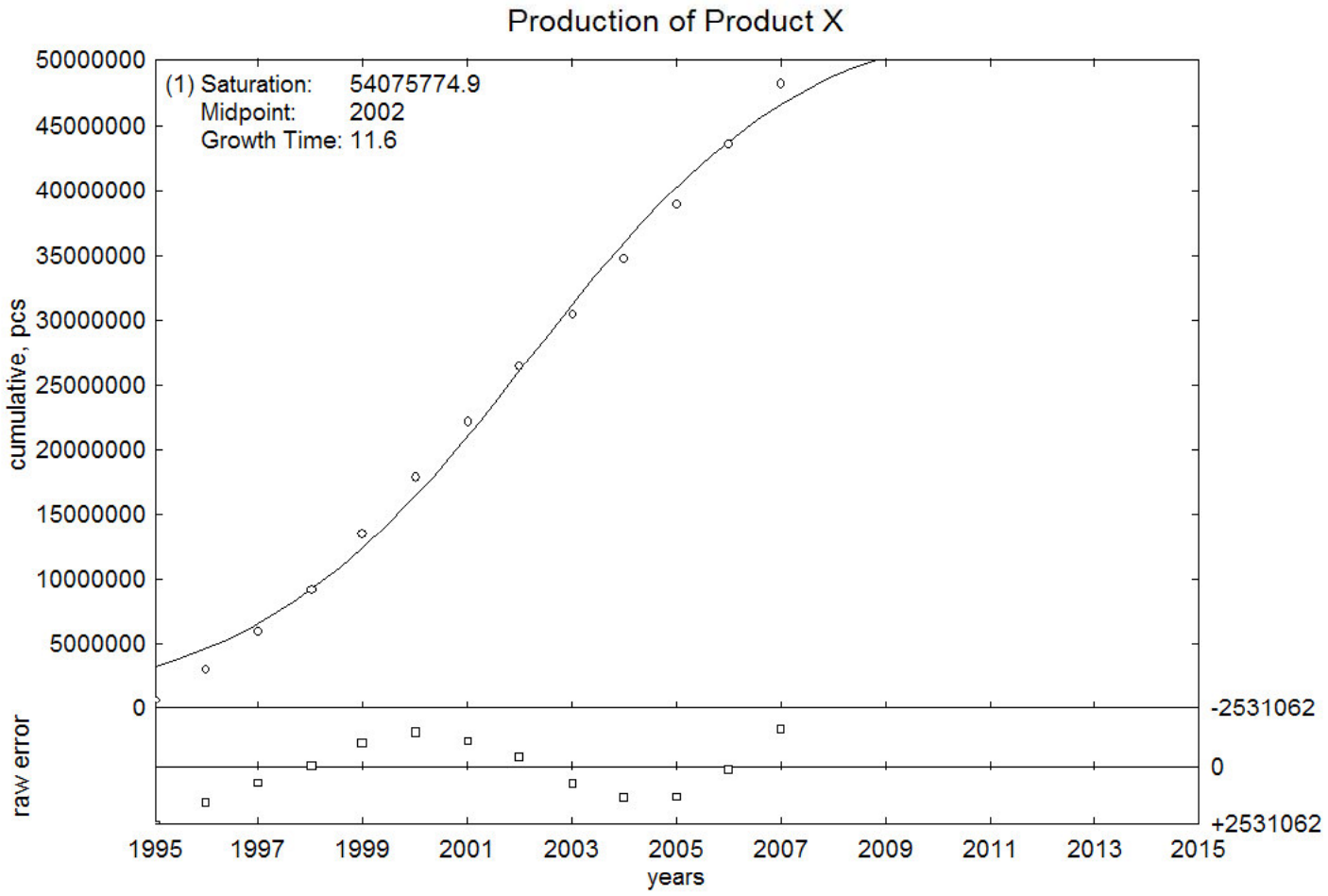
* S-curve fit on data by Loglet Lab Version 1.1.4

2: Component logistic model

[application 2/3: single logistic fitting]



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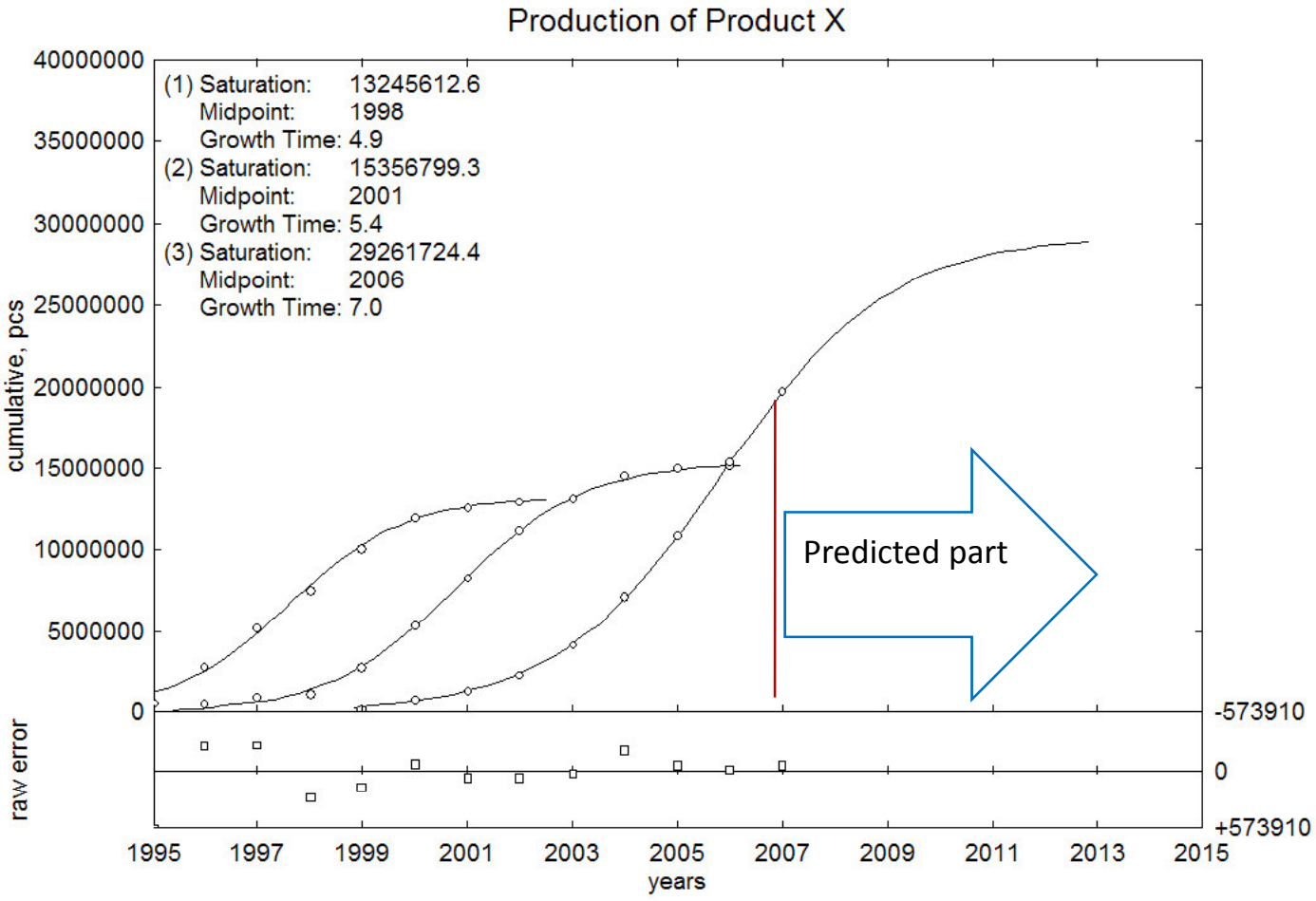
2: Component logistic model

[application 3/3: multi-logistic fitting]



Naive approach and growth measure with physical variable

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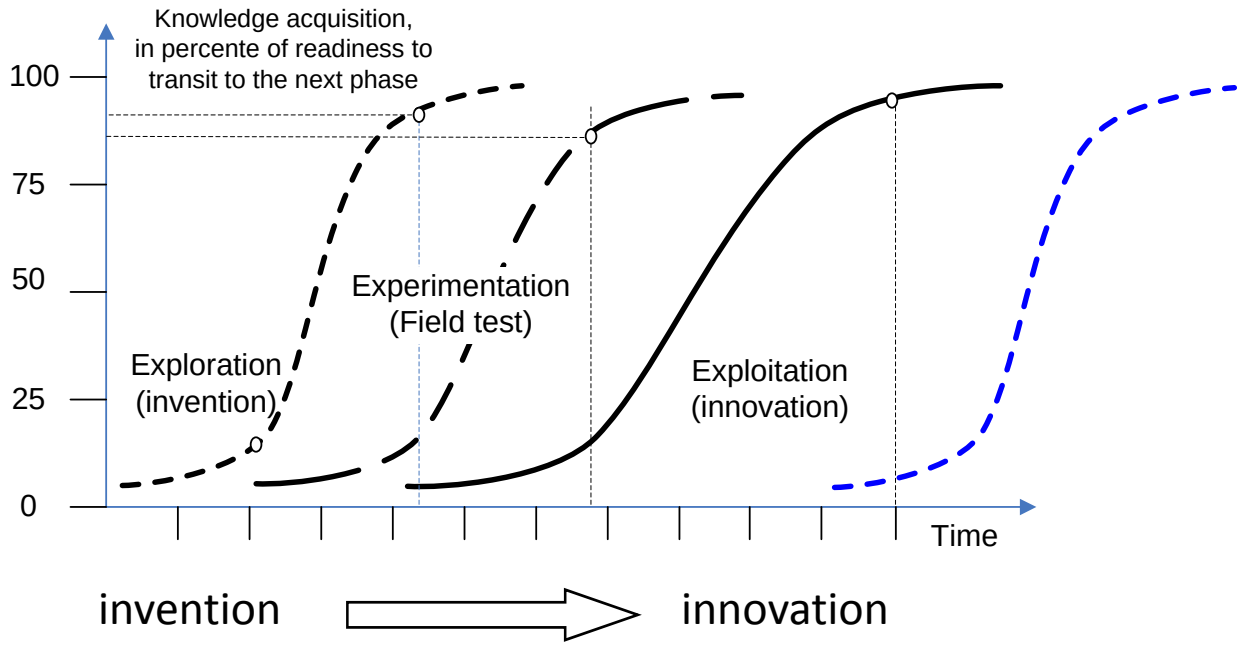
* S-curve fit on data by Loglet Lab Version 1.1.4

3: Growth of knowledge and logistic models

[concepts and remaining problems]

- What kind of information about knowledge should be measured ?
  - before system passes the 'infant mortality' threshold;
    - before having enough data for growing variable trend.



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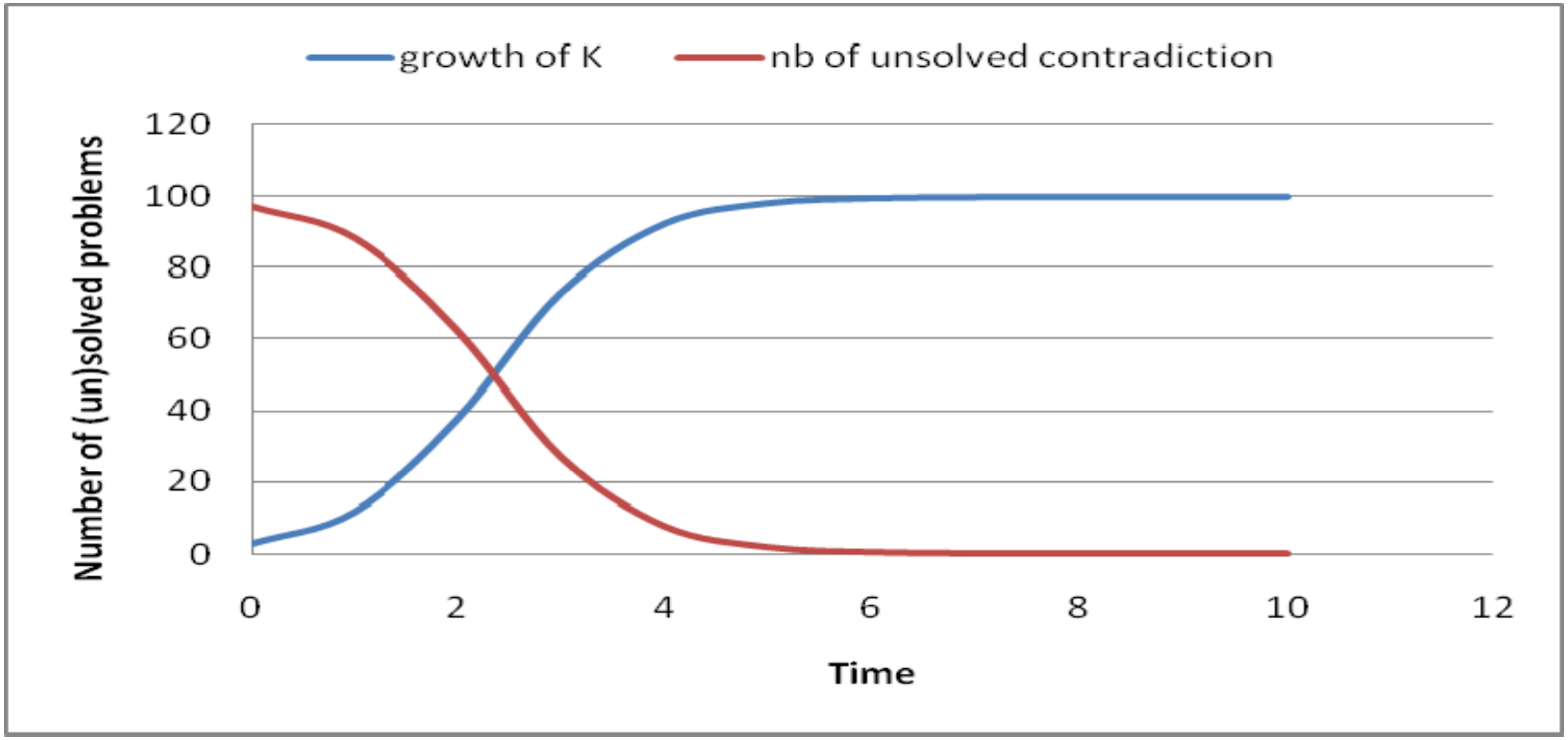
3: Growth of knowledge and logistic models

[contradiction as causal variable]

Future solution = what is already solved(t) + what must be solved(t)



Joint evolution of solved and unsolved contradictions

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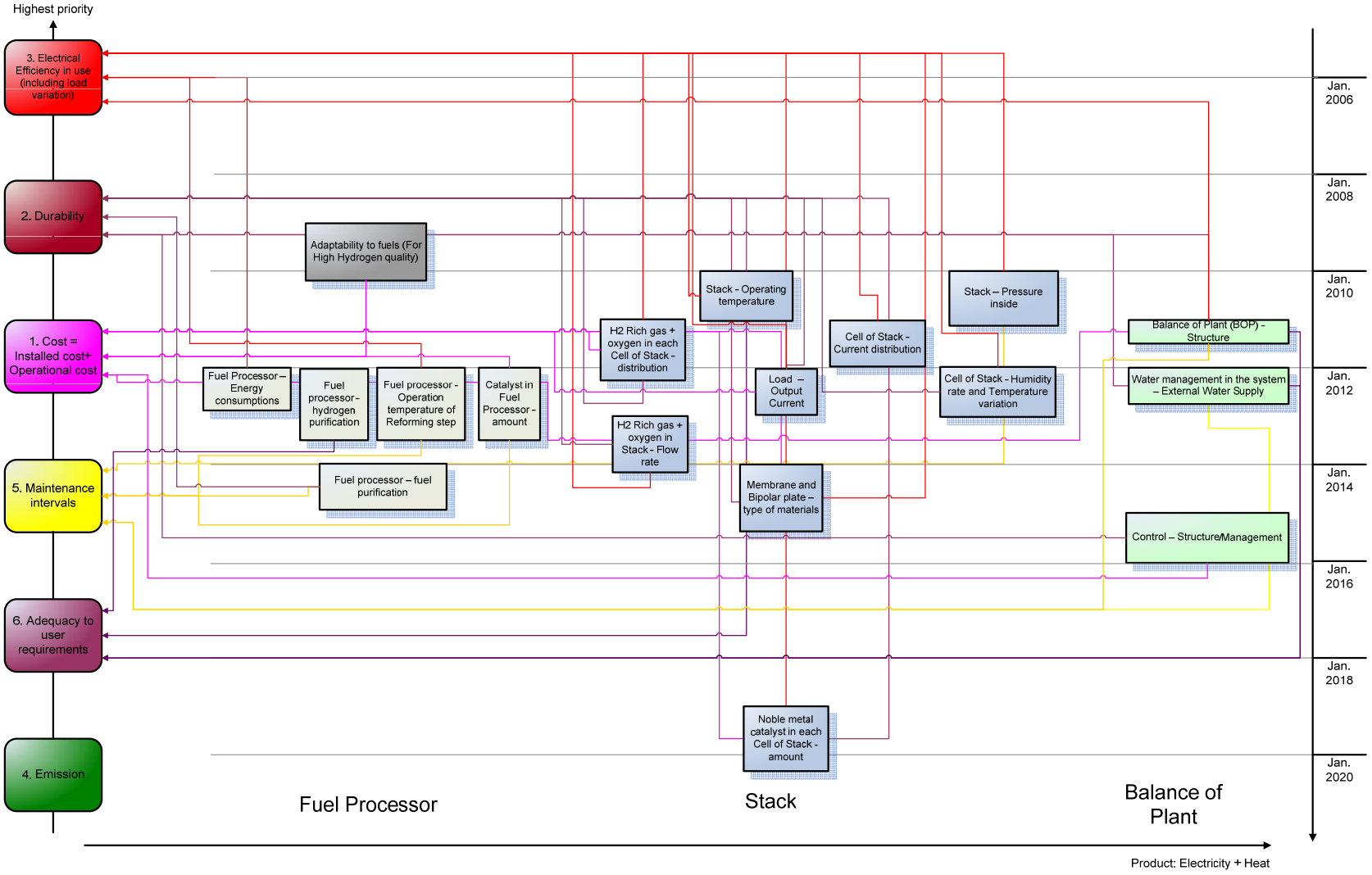
* S-curve fit on data by Loglet Lab Version 1.1.4

3: Growth of knowledge and logistic models

[How to get the data (based on previous work)]



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4: What would we do with it?

[prospective]

It is proposed:

- Validation of causal model as logistic one through experience;
- Discriminate relevant and non relevant contradictions in the network (separate signal from noise);

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Thank you

for your attention :)

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References

1. D. Kucharavy, and R. De Guio, Problems of Forecast, ETRIA TRIZ Future 2005, Graz, Austria, 2005. 219-235.
2. D. Kucharavy, R. De Guio, L. Gautier, and M. Marrony, Problem Mapping for the Assessment of Technological Barriers in the Framework of Innovative Design, 16th International Conference on Engineering Design, ICED'07, Ecole Centrale Paris, Paris, France, 2007.
3. D. Kucharavy, and R. De Guio, Application of S-Shaped Curves, 7th ETRIA TRIZ Future Conference, Kassel University Press GmbH, Kassel, Frankfurt, Germany, 2007.
4. D. Kucharavy, and R. De Guio, Logistic Substitution Model and Technological Forecasting, 8th ETRIA TRIZ Future Conference, University of Twente, Enschede, Netherlands, 2008.
5. C. Marchetti, and N. Nakicenovic, The Dynamics of Energy Systems and the Logistic Substitution Model, International Institute for Applied Systems Analysis, Laxenburg, Austria. 1979.
6. P. S. Meyer, J. W. Yung, and J. H. Ausubel, A Primer on Logistic Growth and Substitution: The Mathematics of the Loglet Lab Software, Technological Forecasting and Social Change, 61(3), (1999) 247-271.
7. P. Llerena, and E. Schenk, Technology Policy and A-Synchronic Technologies: The Case of German High-Speed Trains, in Innovation Policy in a Knowledge Based Economy, P. Llerena and M. Matt, eds., Springer, Berlin, 2005, 115-134.
8. N. Khomenko, R. De Guio, L. Lelait, and I. Kaikov, A Framework for OTSM-TRIZ Based Computer Support to be used in Complex Problem Management, International Journal of Computer Applications in Technology (IJCAT), 30(1/2), (2007) 88-104.