Organizational Systems Engineering & Renewable Energy

George W. L. Sousa, PhD

Introduction

George W. L. Sousa

- ✓ **INCOSE** Ambassador in Brasil
- ✓ PhD, **Industrial & Systems Engineering** (VIRGINIA TECH, 2004)
- ✓ MS, Production Engineering (USP São Carlos, 1999)
- ✓ Production Engineer (USP São Carlos, 1997)

- ✓ Founder and CEO at **Engeflux Engenharia de Sistemas** Ltda
- ✓ Founder and Vice President at Enerflux Agroenergia Ltda
- ✓ Business Development Director at Fertilizantes Aliança Ltda
- ✓ Invited Professor, Production Engineering PUCGOIÁS

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What is an organization?

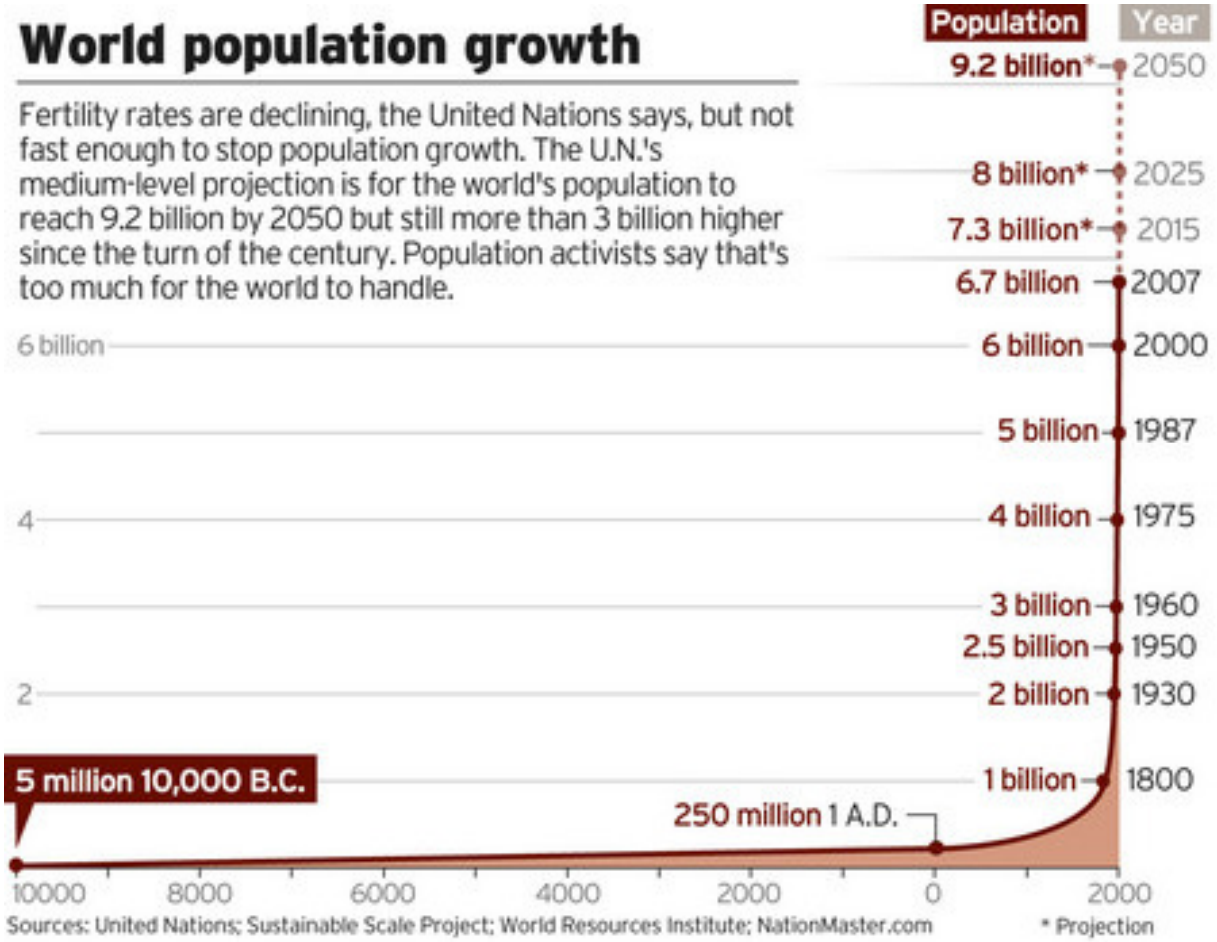
Organizations appear when individuals unite in search for a purpose

Why we need high performance organizations?

Why we need high performance organizations?

Increasing sophistication of performance criteria from stakeholders

Why we need high performance organizations?



population growth & industrial revolution

Why we need high performance organizations?

the world needs more energy

Why we need high performance organizations?






all types of energy

Why we need high performance organizations?

and more food

Why we need high performance organizations?

and more water

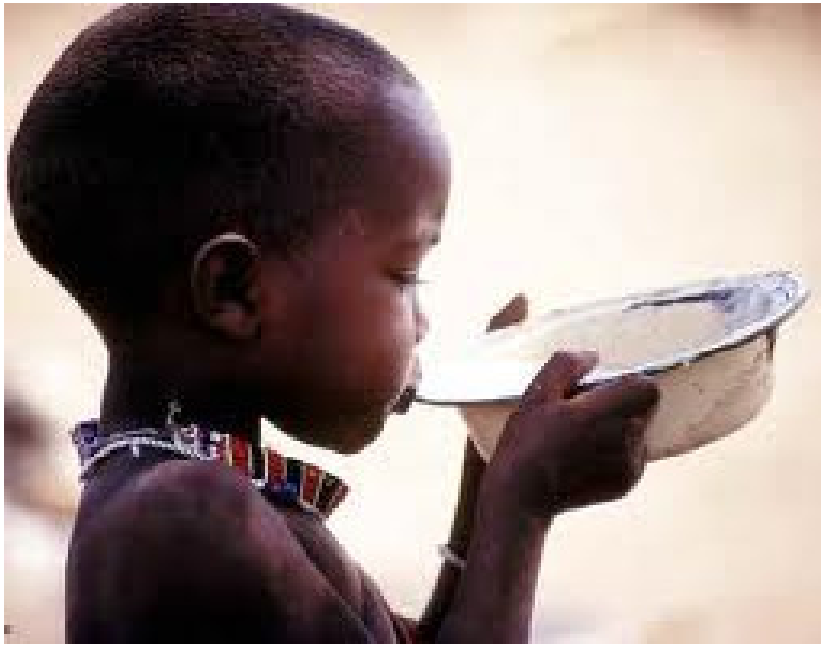
Why we need high performance organizations?

...in a context of increasing integration and complexity

Why we need high performance organizations?

insatisfaction

Why we need high performance organizations?



hunger

Why we need high performance organizations?

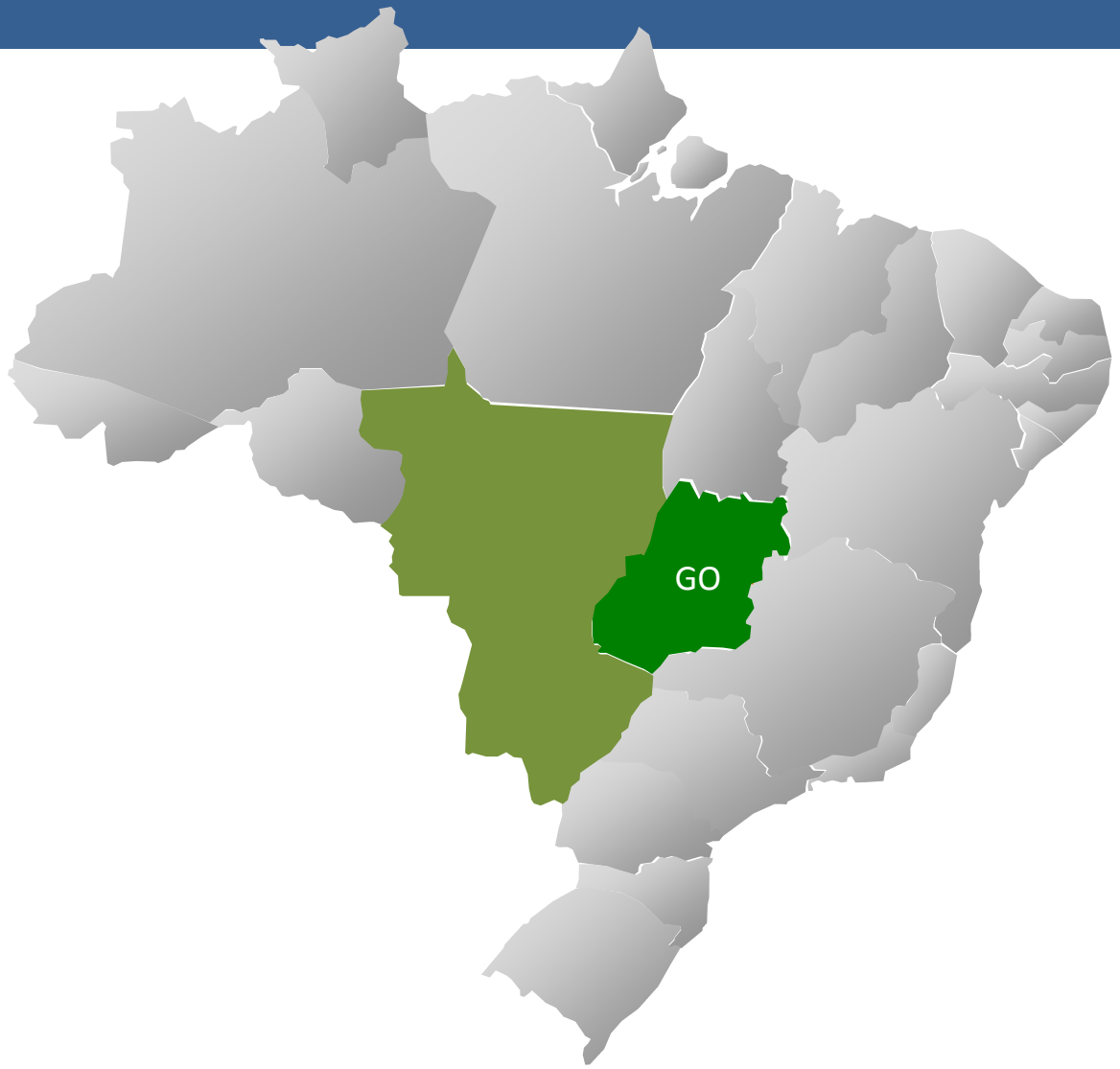
thirst

Why we need high performance organizations?

dispute for energy and other scarce resources

Brazil Role

BRAZIL | MIDWEST | GOIÁS



BRAZIL | MIDWEST | GOIÁS

Source: Goiás Multimodal Logistic Plataform. http://www.plataformalogistica.go.gov.br/plataforma/4.htm Accessed in 12/04/2011.

BRAZIL | MIDWEST | GOIÁS

In order to deal with these challenges we need to learn how to better engineer systems

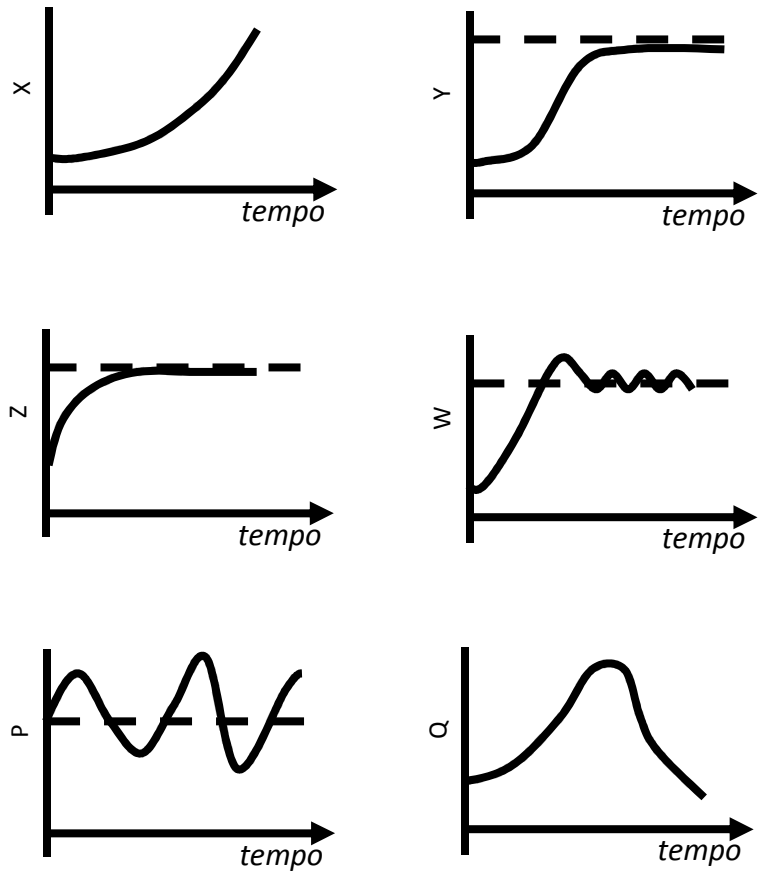
What does it mean to engineer an organizational system?

SYSTEM PERFORMANCE

&

SYSTEM STRUCTURE

What is performance?



What is structure?

people

Materials

software **resources**

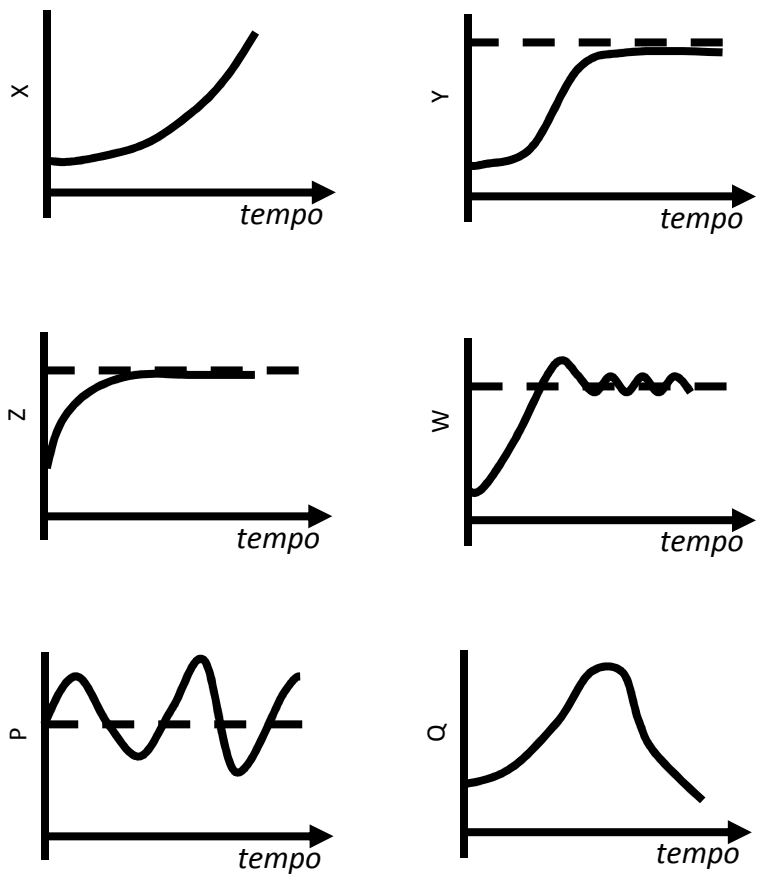
INFORMATION

energy

EQUIPMENT

Processes

Performance = F (Structure)



people

Materials

software **resources**

INFORMATION

energy

EQUIPMENT

Processes

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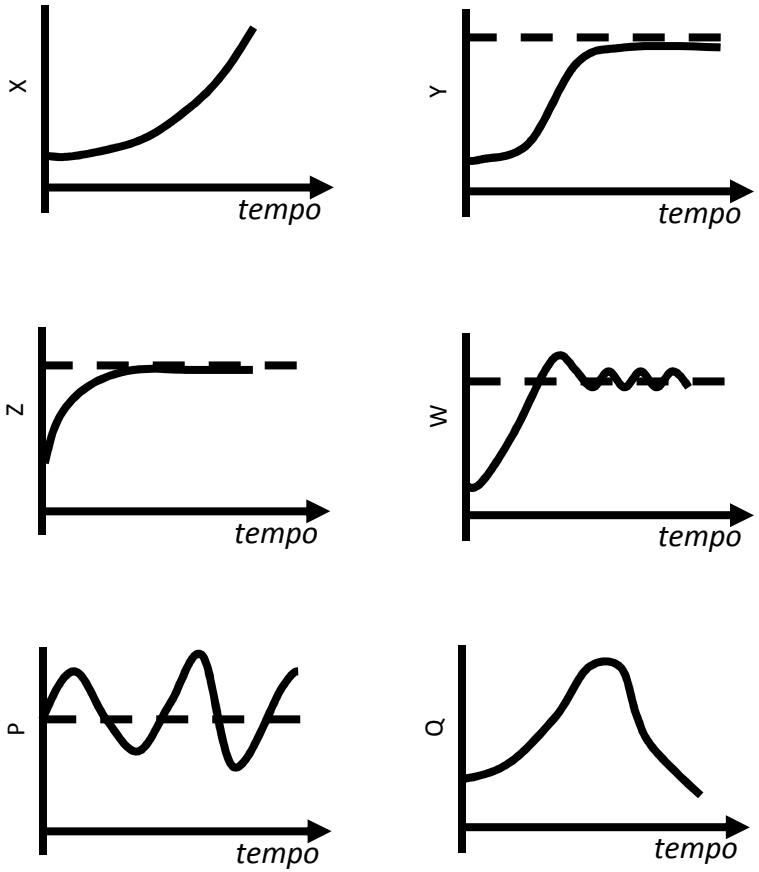
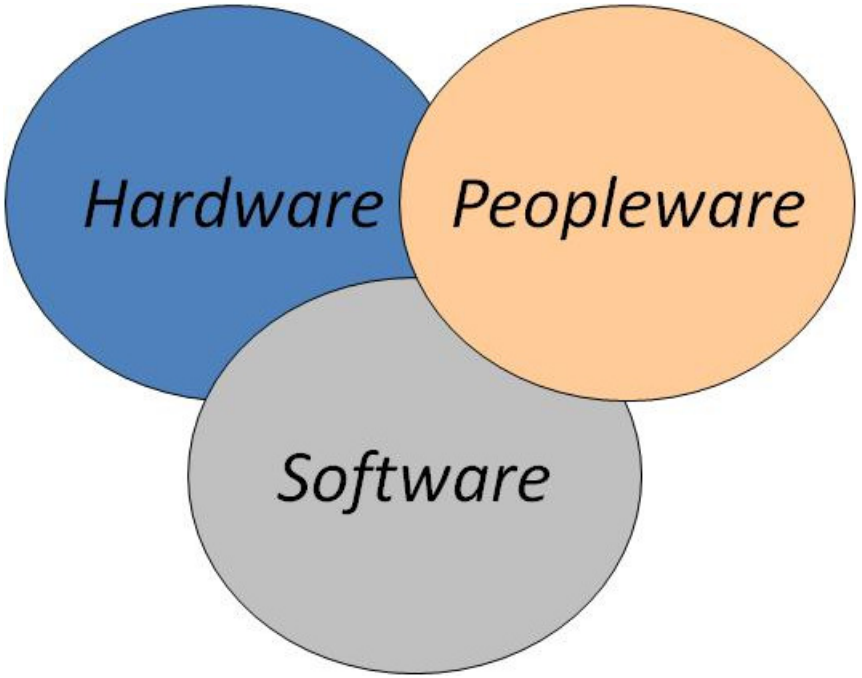
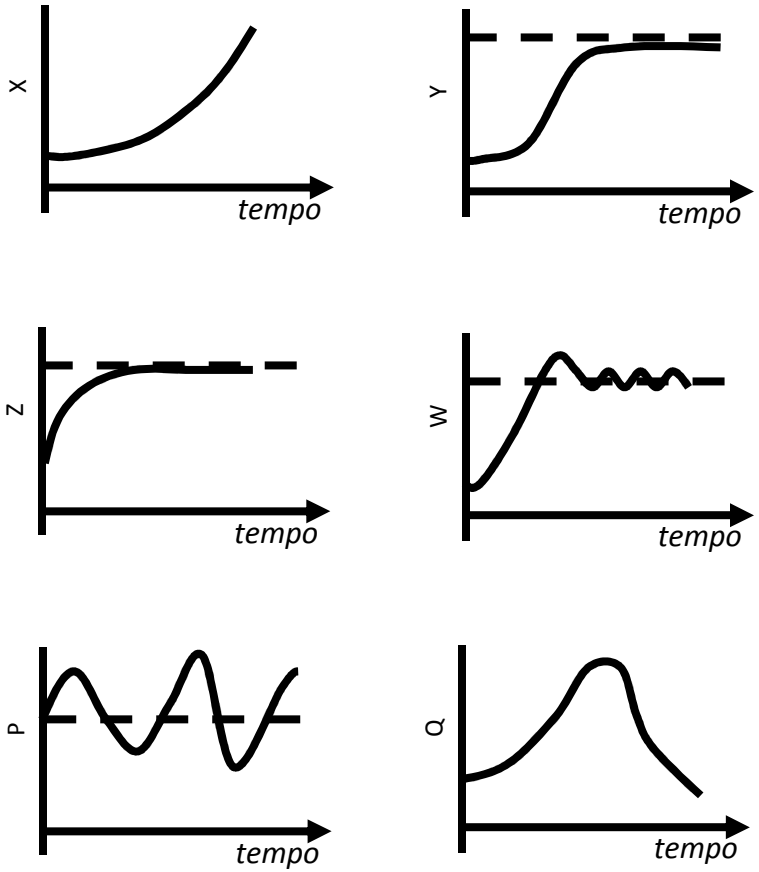
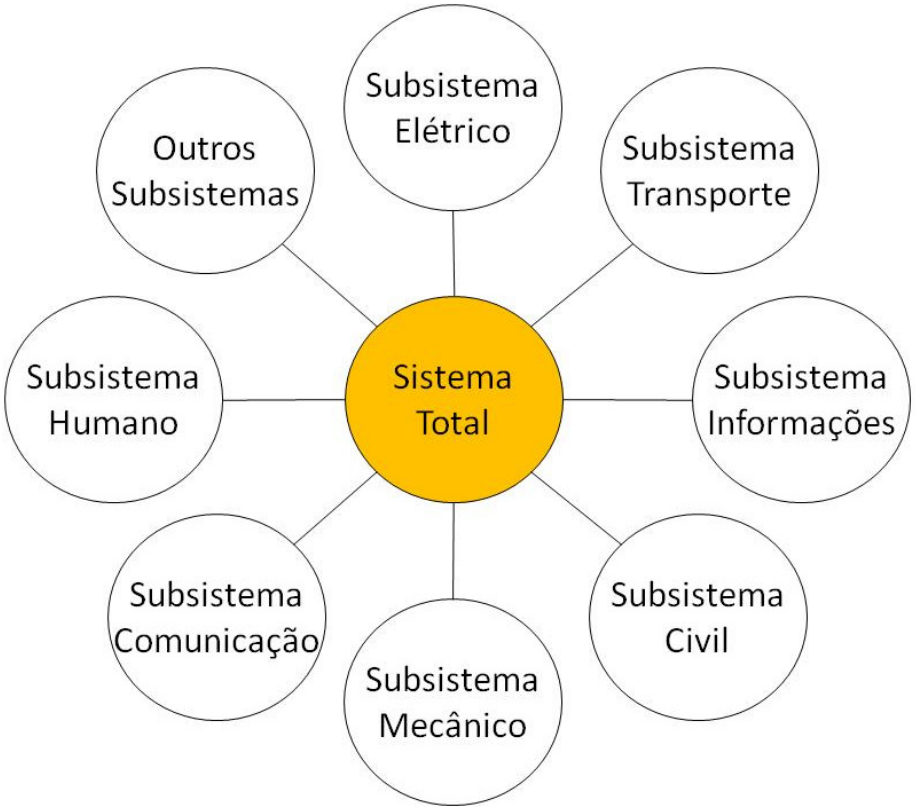




component classification

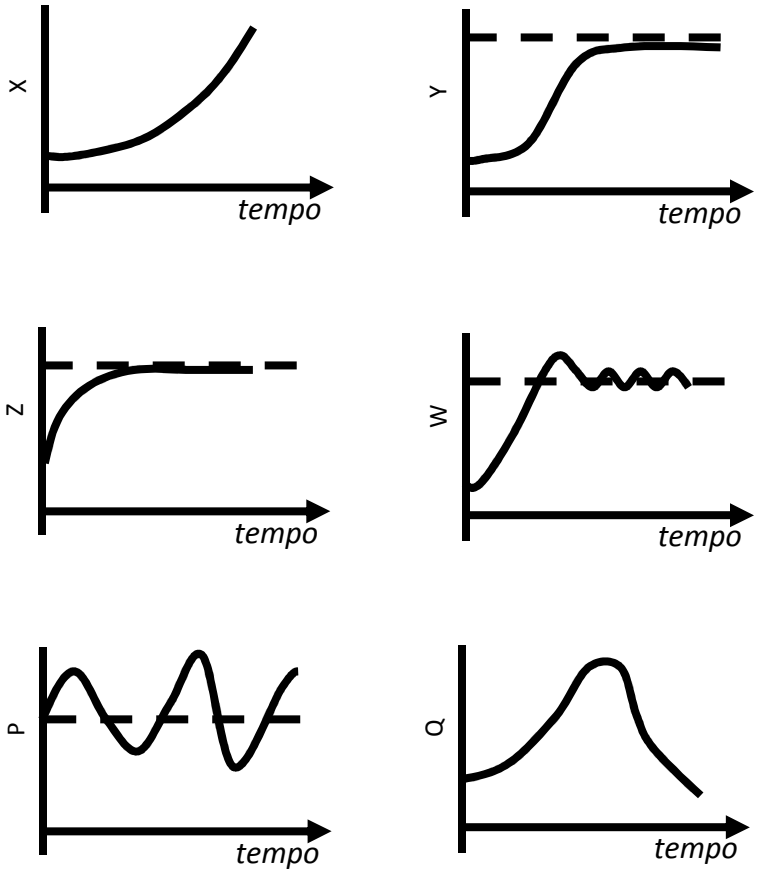
Performance = F (Structure)

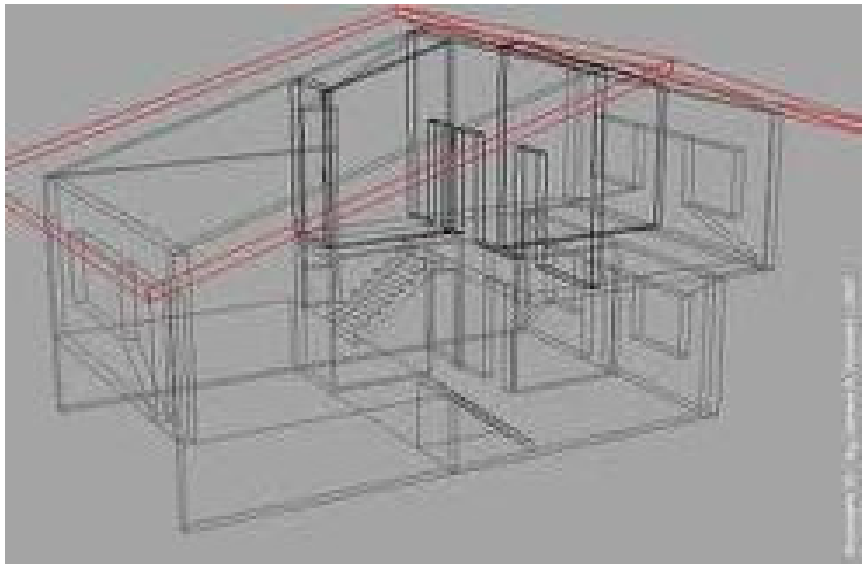




subsytems diagram

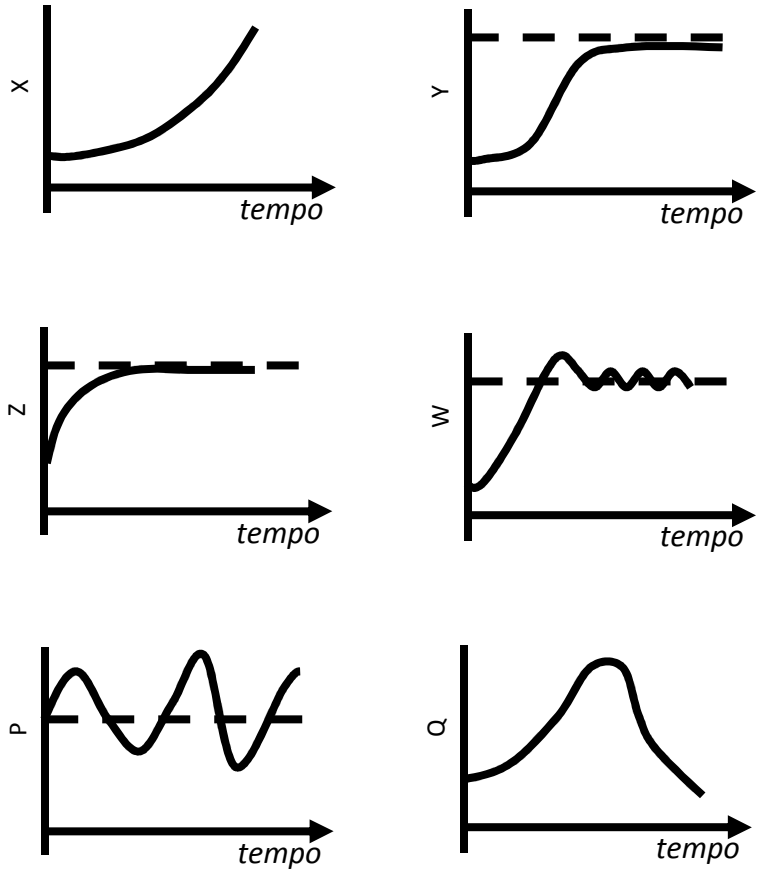
Performance = F (Structure)

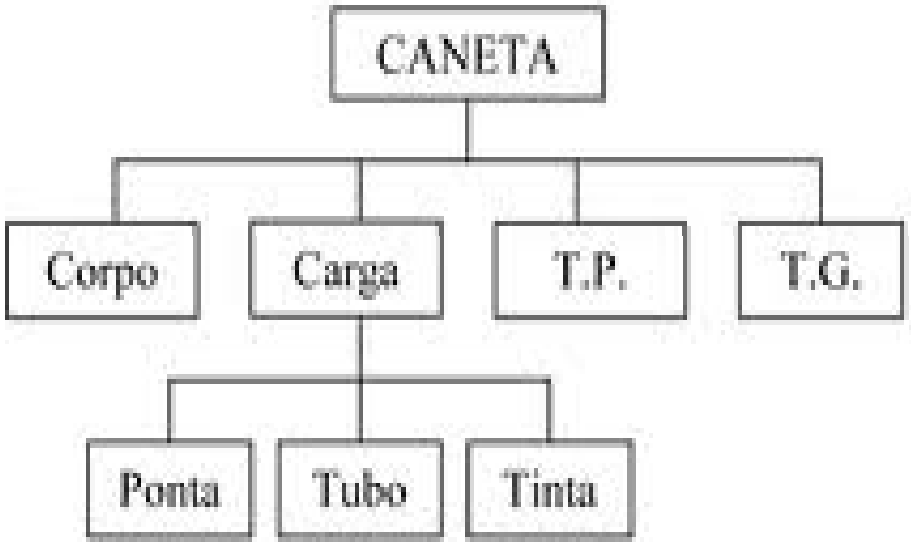




facilities specification

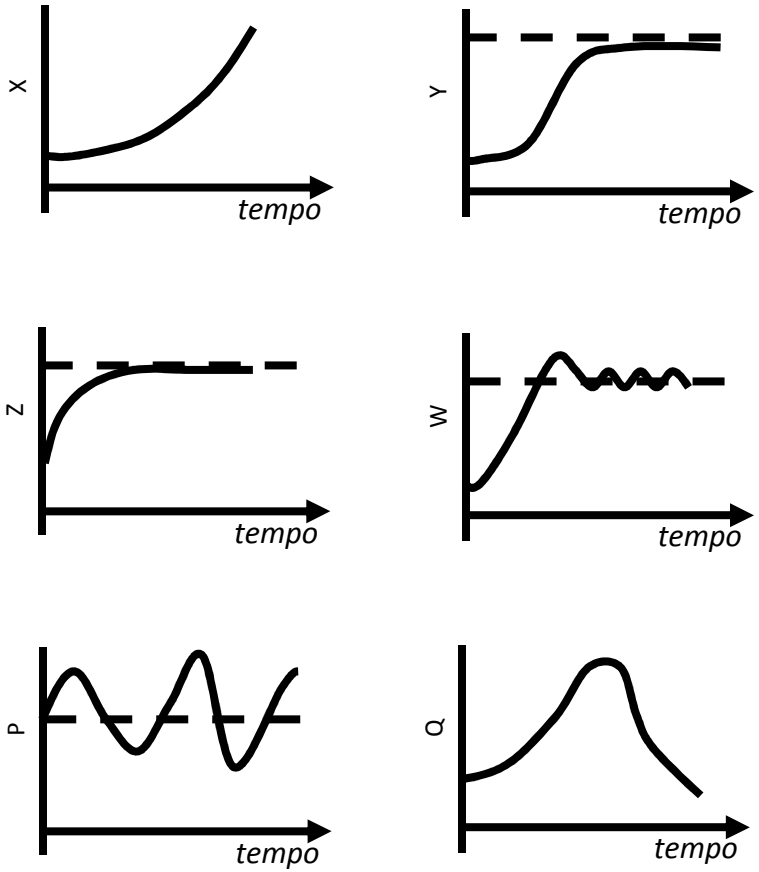
Performance = F (Structure)

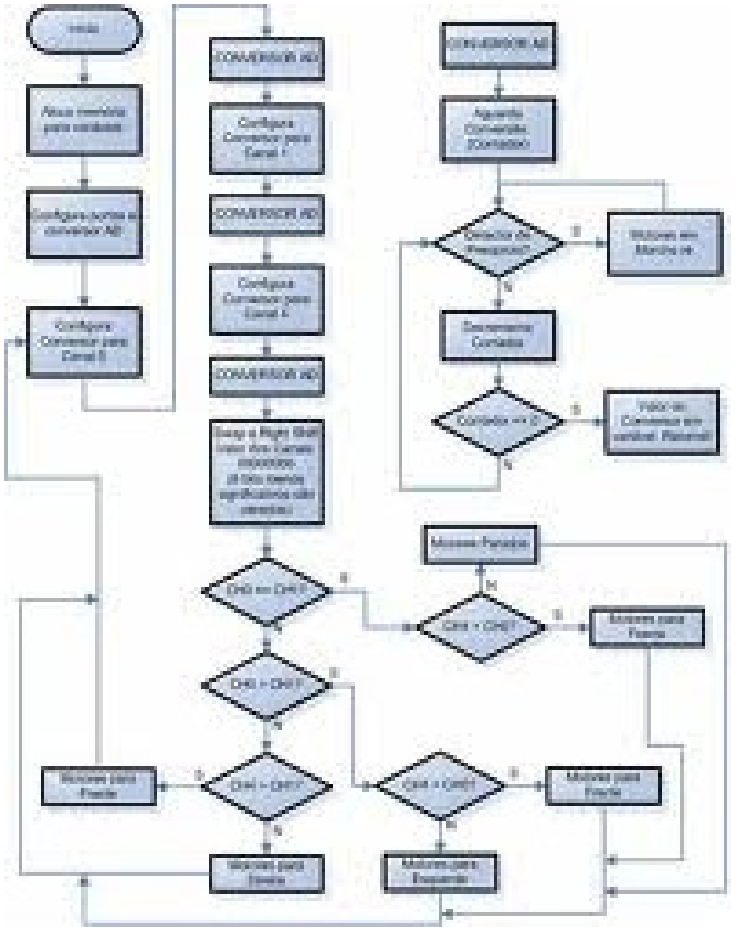




product tree

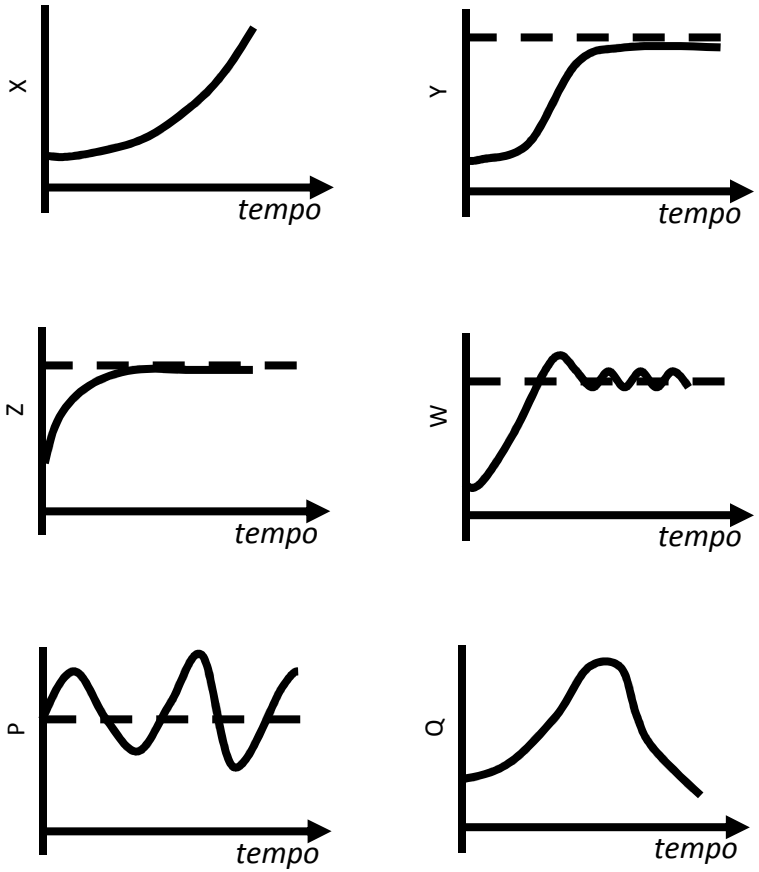
Performance = F (Structure)





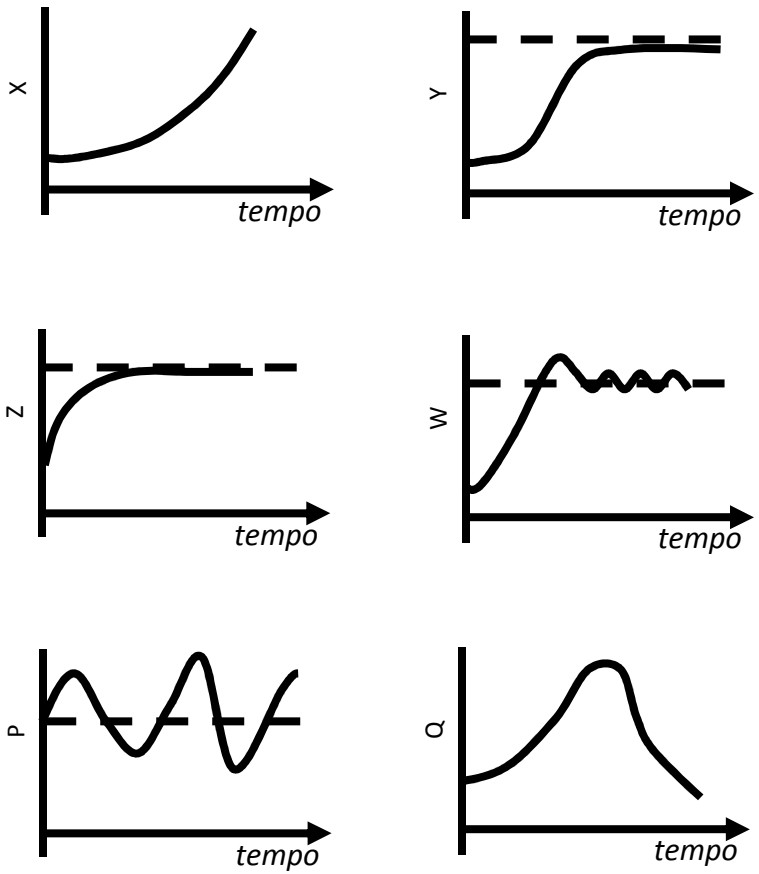
(process) flow diagrams

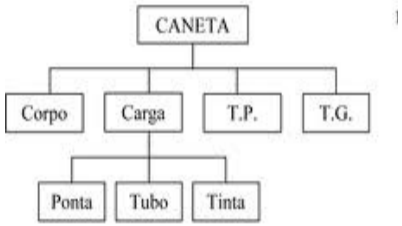
Performance = F (Structure)



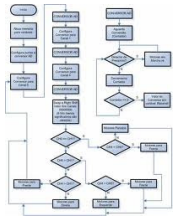
organograms

Performance = F (Structure)



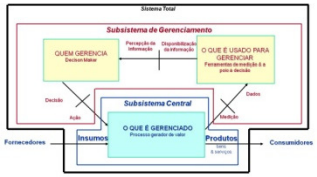


product tree

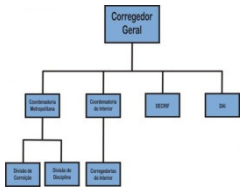


macro processes

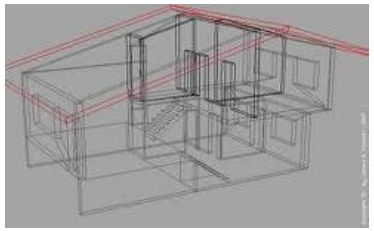
Causal loop diagrams w ith stocks and flows



control architectures

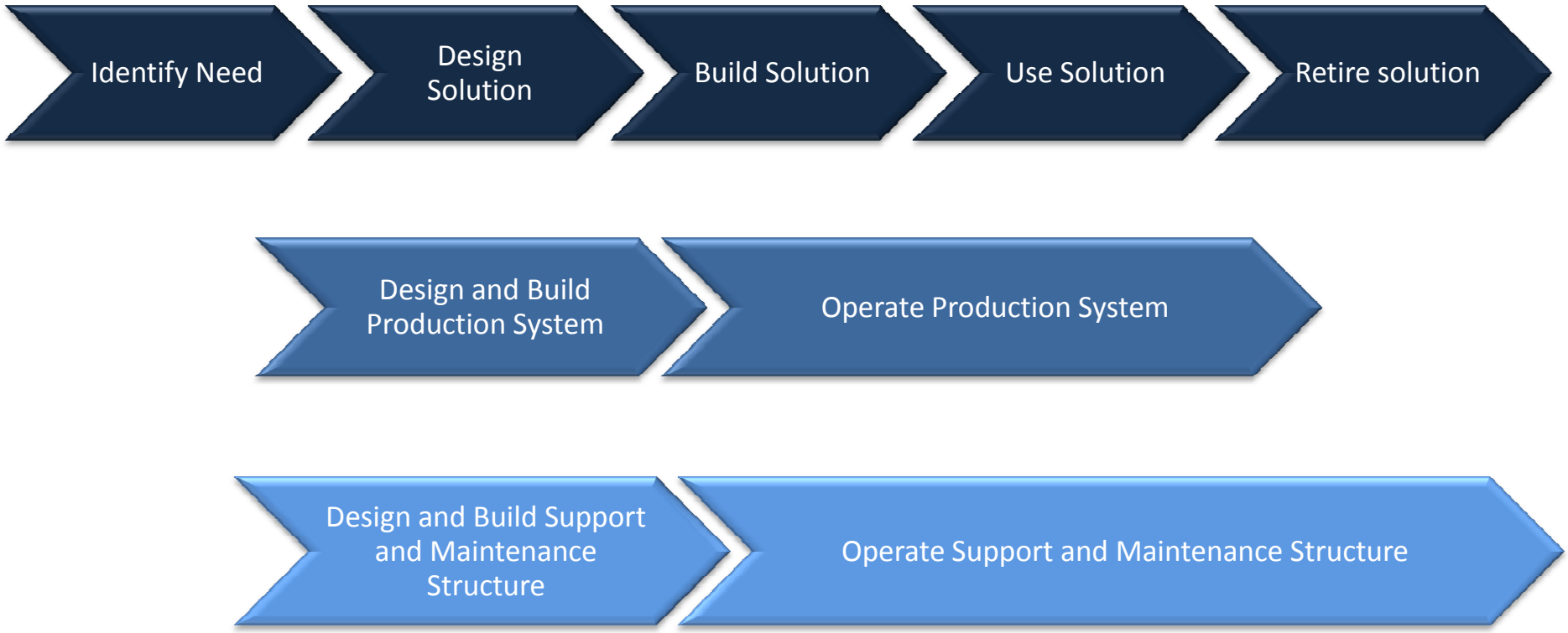


organogram



facilities specification

Systems Life Cycle



Source: Adapted from BLANCHARD, B. S. & FABRYCKY, W. J. (1998). **Systems Engineering and Analysis**. Third Edition. Prentice Hall, Upper Saddle River, New Jersey.

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ENGENHARIA DE SISTEMAS

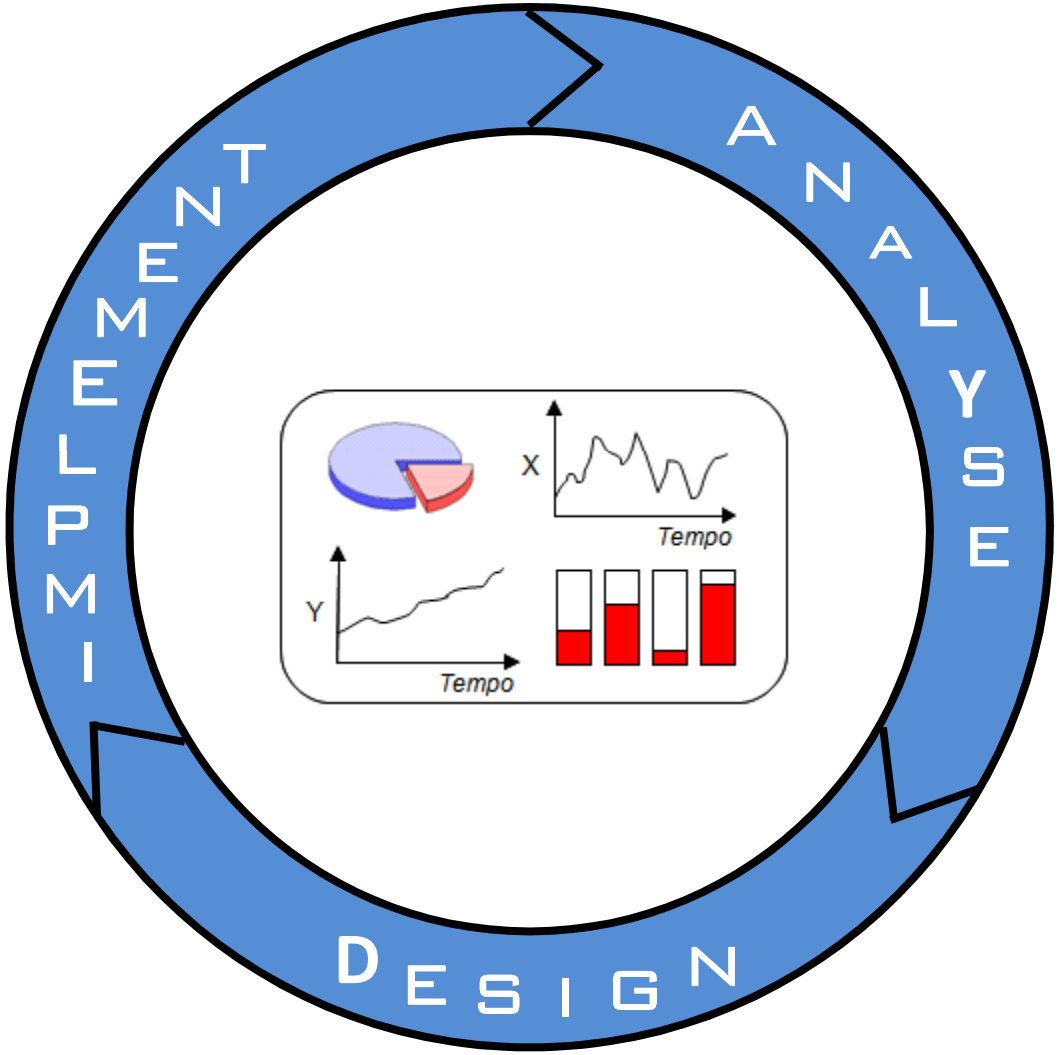
PENSO

VIRGINIA TECH
MIT
BABSON COLLEGE
UNIVERSITY OF SÃO PAULO
INCOSE
SYSTEM DYNAMICS SOCIETY
LEAN ENTERPRISE INSTITUTE

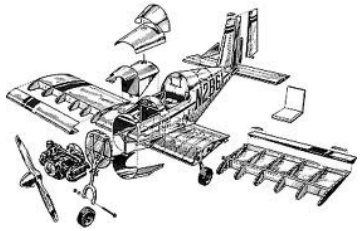
PENSO

Processo de **En**genharia de **S**istemas **O**rganizacionais

PENSO: Analyse | Design| Implement



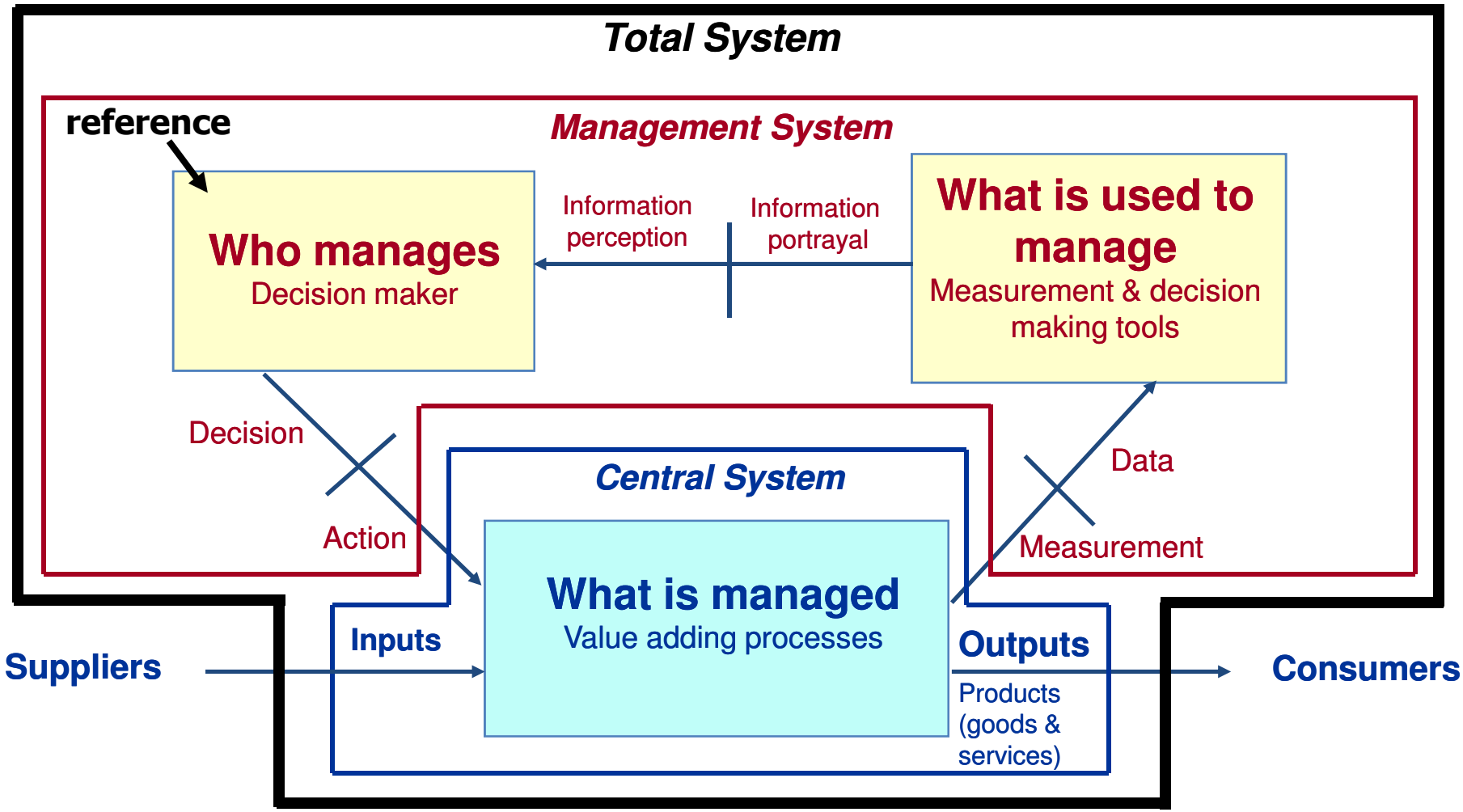
Development versus Operation



development

operation

Organizational Systems Structure



Source: adaptated from KURSTEDT, H. A. (2000). **Management Systems Theory, Applications, and Design**. Virginia Tech. Blacksburg, VA, EUA. Autor.

How process flow is controled?

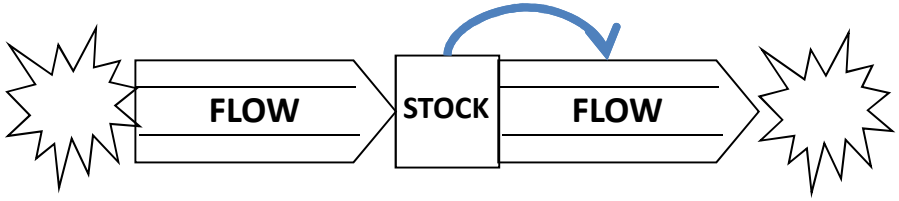
PUSH

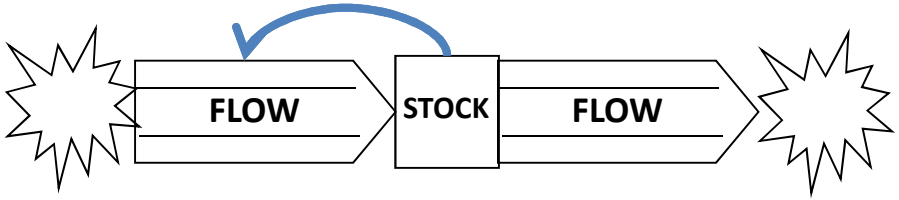
versus

PULL

How process flow is controled?

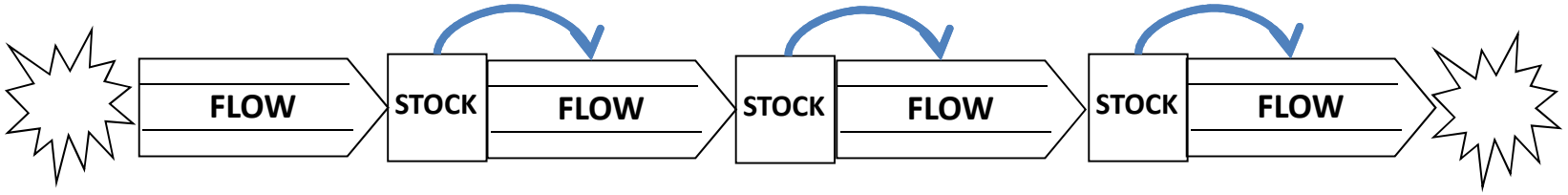
PUSH

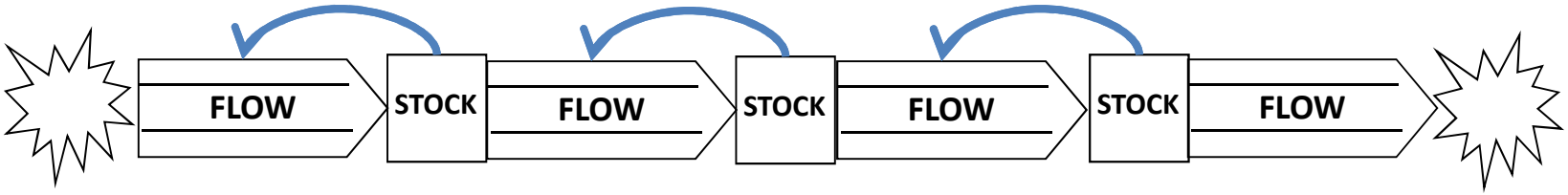




PULL

How process flow is controled?





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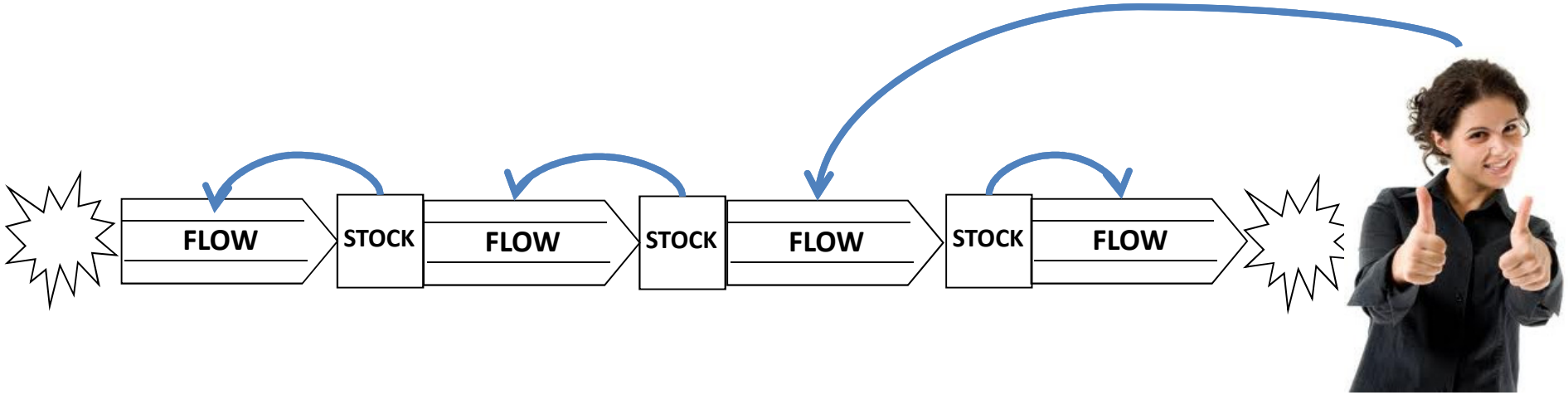
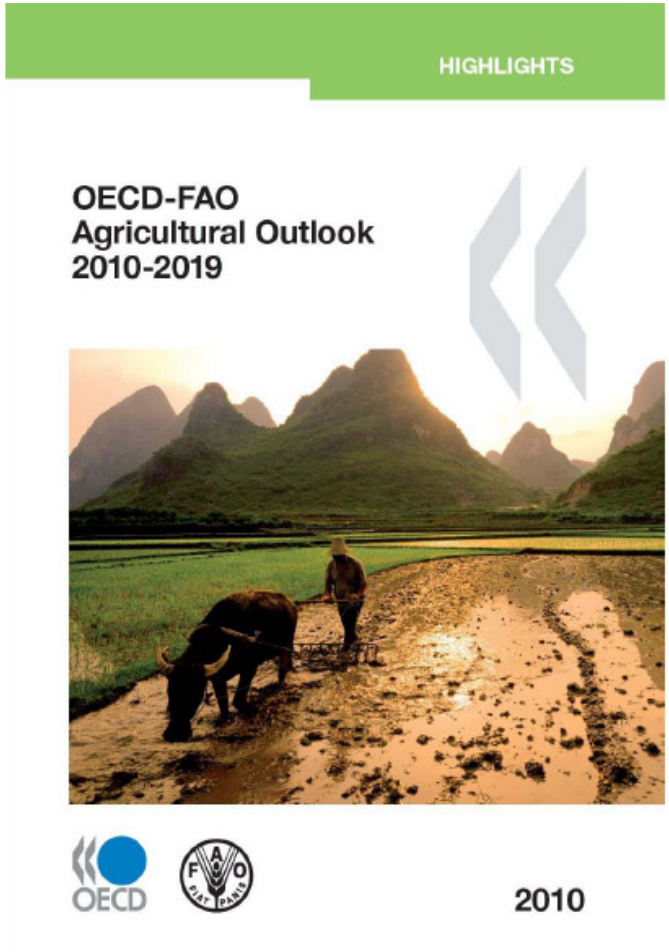


Sustainable Development Challenge



- ✓ 70% increase in food production by 2050
- ✓ Brazilian agricultural production is expected to increase 40% by 2019
  - Brazil will provide the biggest agricultural yield in the next decade

FONTE: FAO (Food and Agriculture Organization) e OCDE (Organization for Economic Co-operation and Development). (June 2010).

Challenge: sustainable food and energy agriculture

Water & vinhaça irrigation

Manual harvesting

Mechanical harvesting

Biomass movimentation

Challenge: sustainable food and energy agriculture

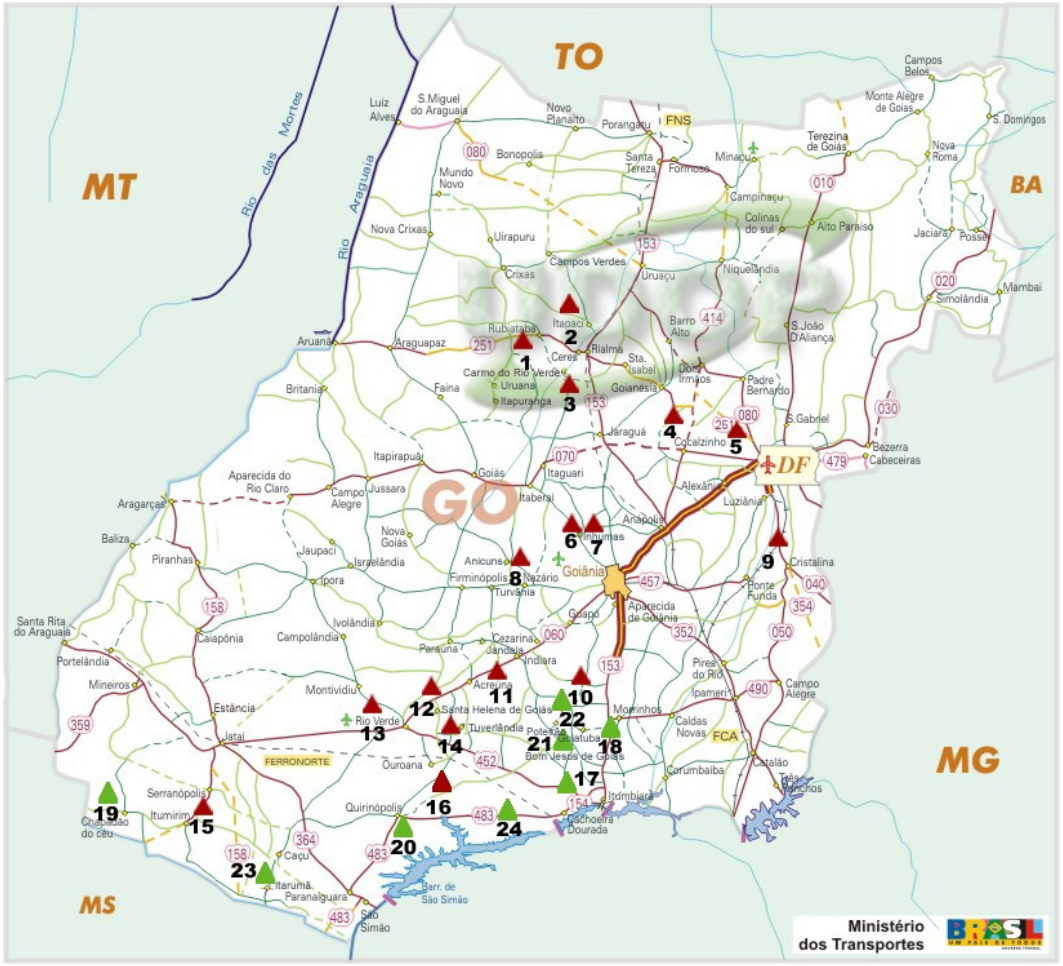
Logistics

Fermentation containers

Distilation columns

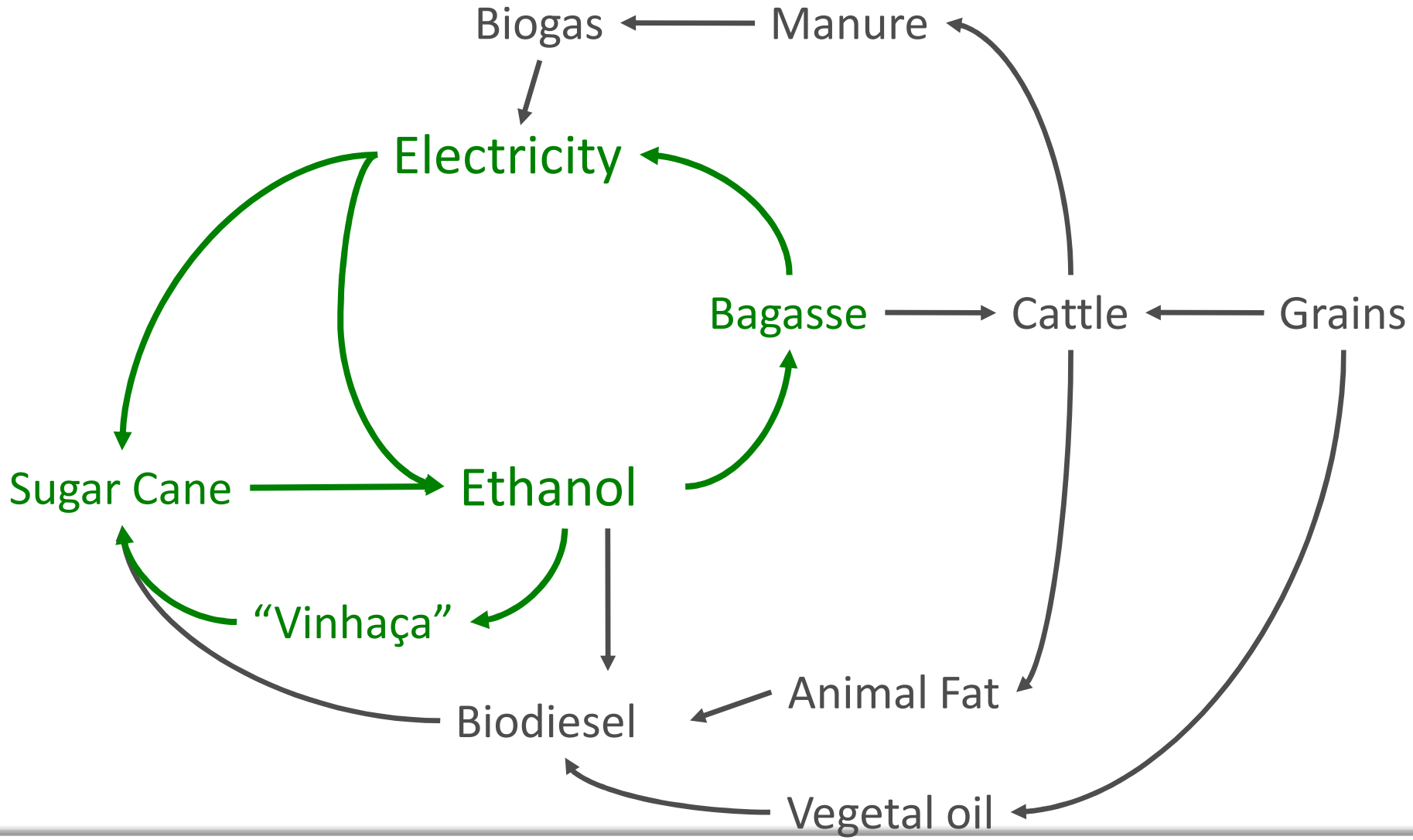
Ethanol storage

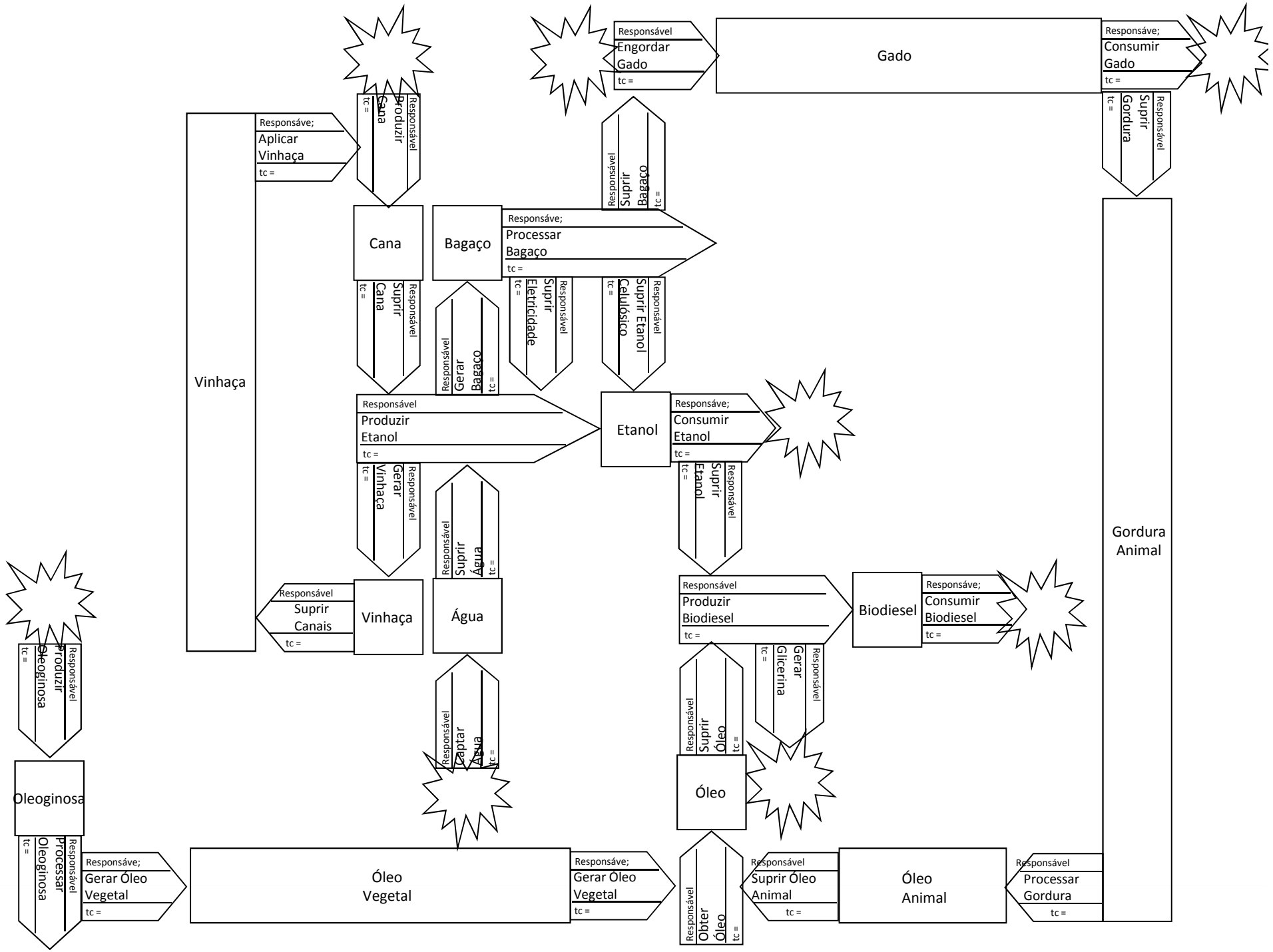
Challenge: sustainable food and energy agriculture



Fonte: UDOP (2004) – União dos Produtores de Bionergia (http://www.udop.com.br/mapa/geral_mapa.php?estado=go)

Challenge: sustainable food and energy agriculture




Responsável
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Aplicar
Vinhaça
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Suprir
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Gado
tc =
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Consumir
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tc =
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Suprir
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Bagaço
tc =
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Suprir Etanol
Celulósico
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tc =
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Gerar Óleo
Vegetal
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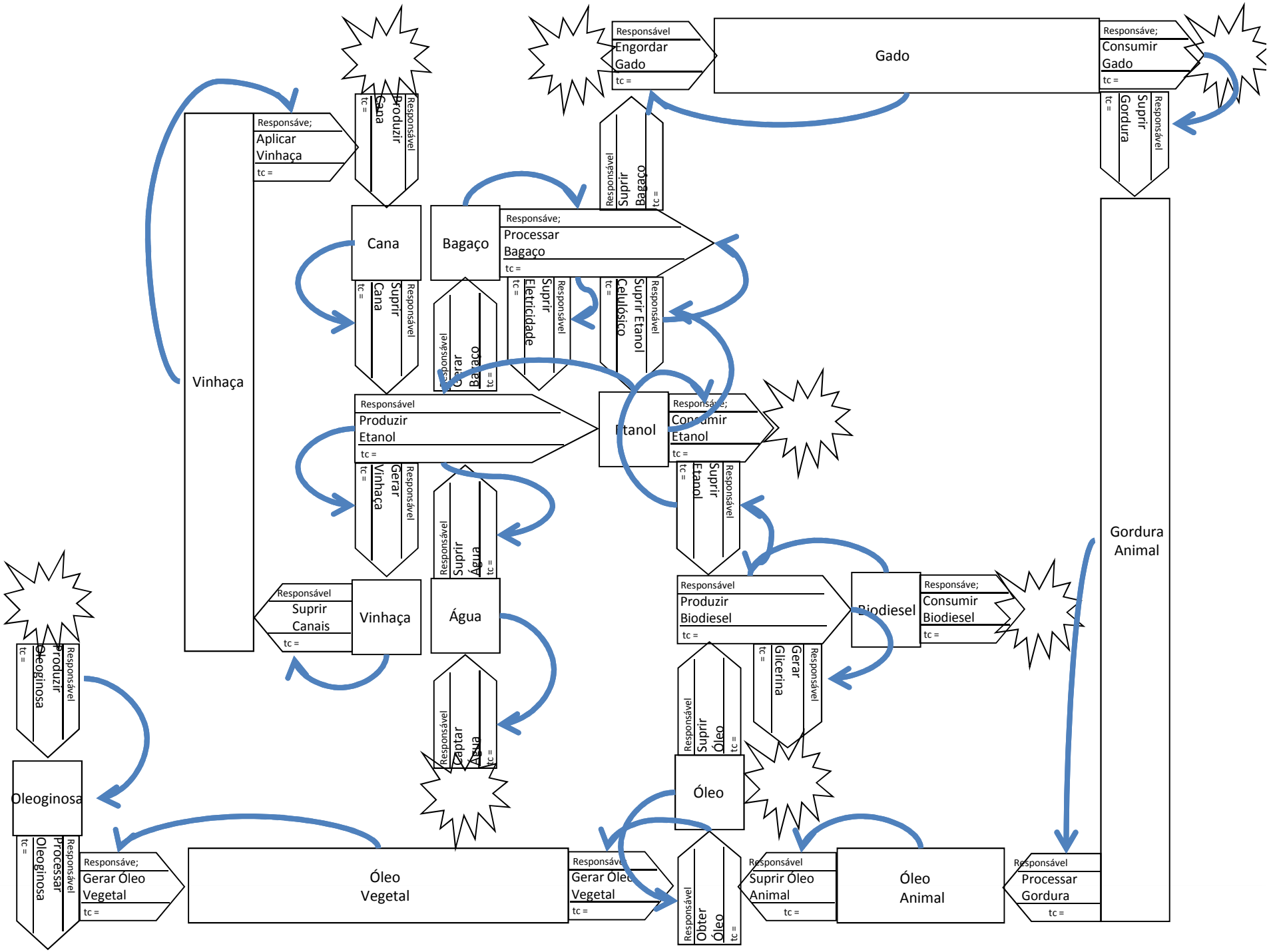
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Suprir Etanol
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Canais
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tc =
Óleo
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Responsável
Processar
Gordura
tc =

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PENSO

george.sousa@engeflux.com