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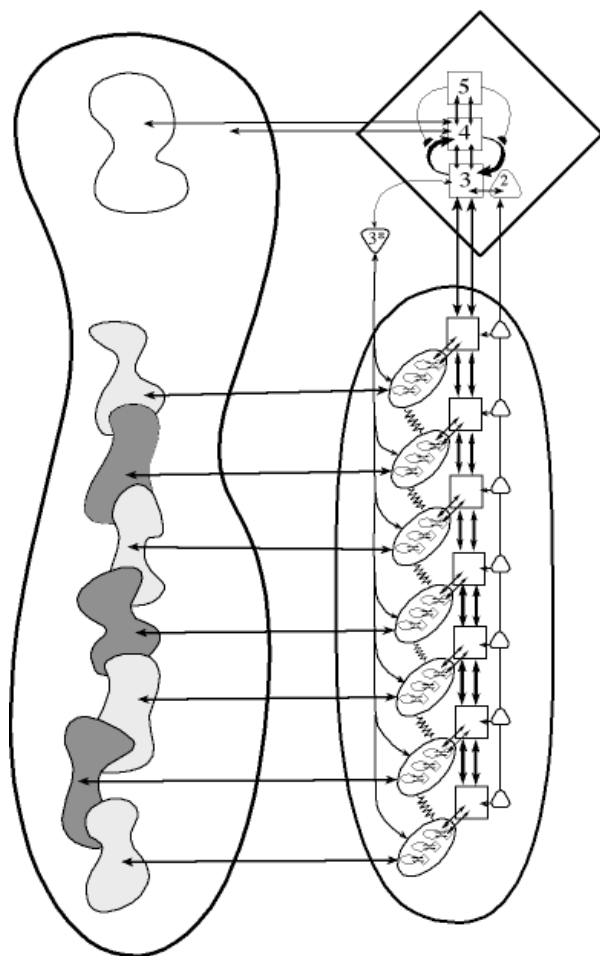
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# "Teoria de Complejidad y Cibernética organizacional: Aplicaciones y perspectivas de uso en el campo de seguridad y manejo de riesgo"

Dr. Pedro Pablo Cardoso

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## 1- Conceptos generales

- Sistemas y Pensamiento de sistemas
- Complejidad – Problemas complejos
- Caja de herramientas: SD; SNA, Cibernética Organizacional

## 2- Ejemplos de aplicación

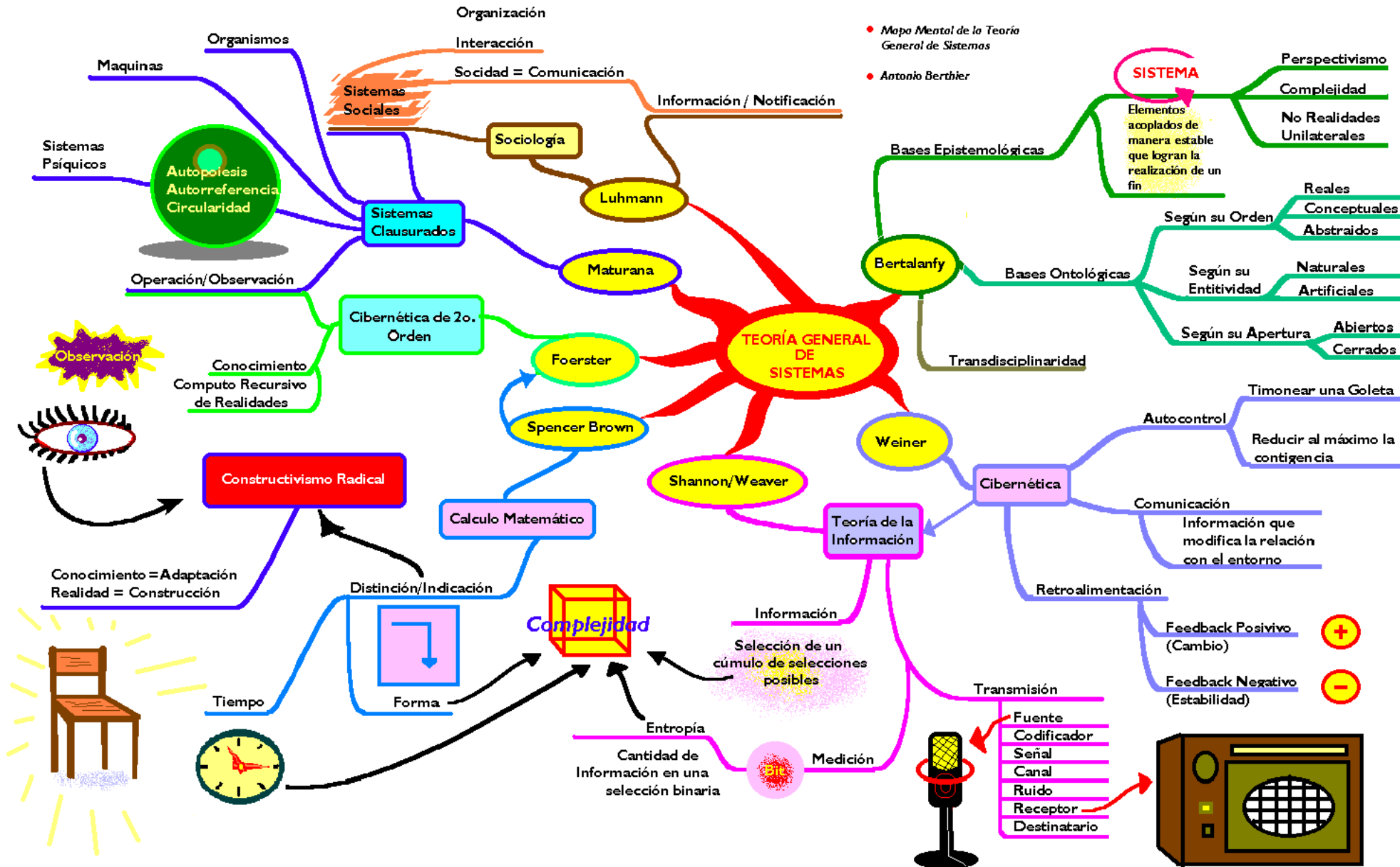
- VSM y diseño de sistemas de defensa
- VSM y Sistemas de Defensa Total
- VSM y gestión de riesgo (desastres)
- VSM ofensiva
- DS y seguridad y toma de decisiones (Sensitivity Analysis / Malik)

### 3- Nuevos proyectos

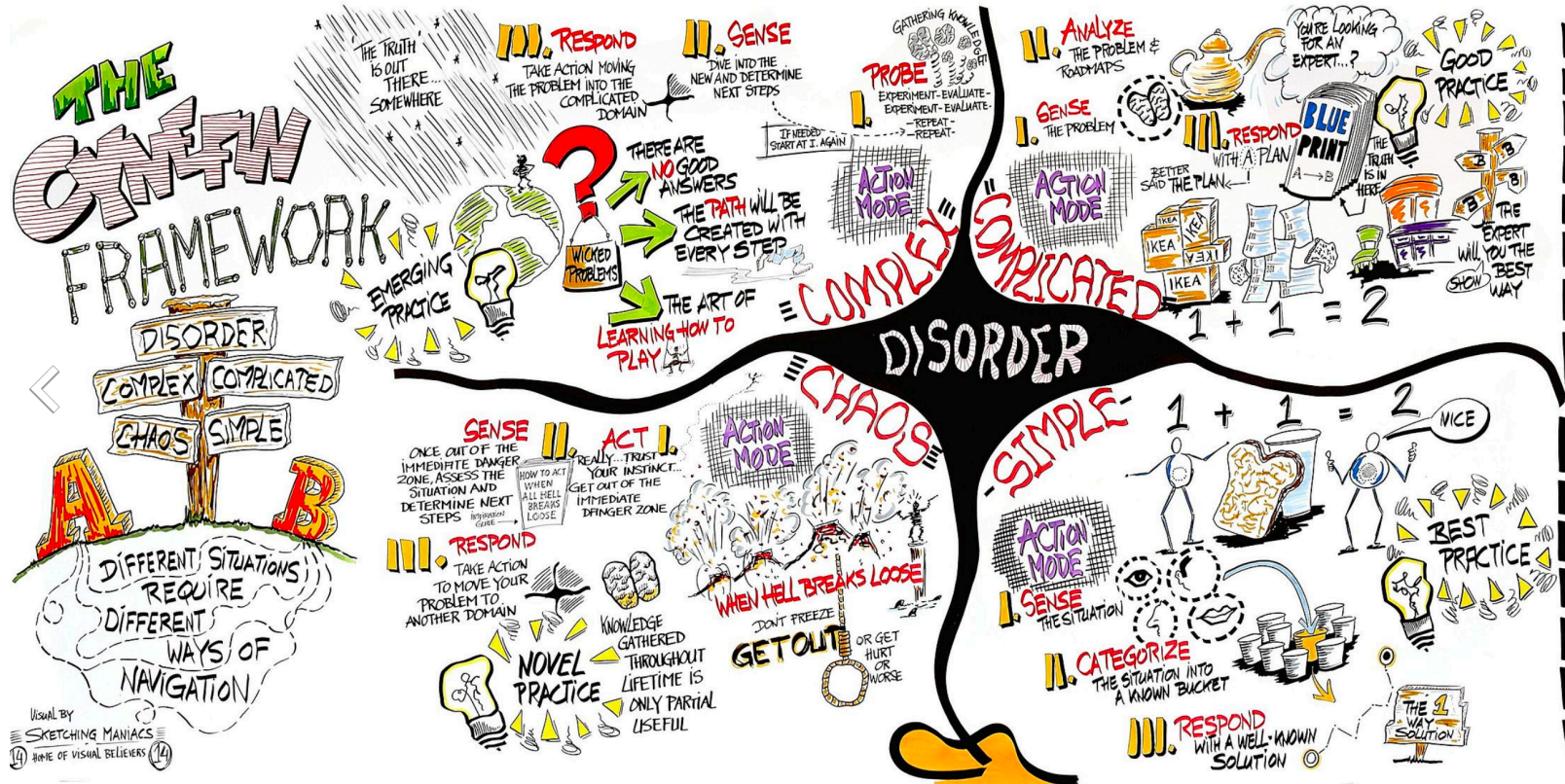
- VSM y sistemas dinámicos
- VSM y Análisis Avanzado de Redes Sociales

## 4- Q&A

# 1- Conceptos Generales: sistemas y pensamiento de sistemas



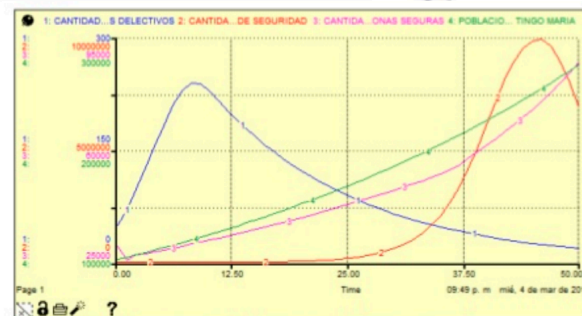
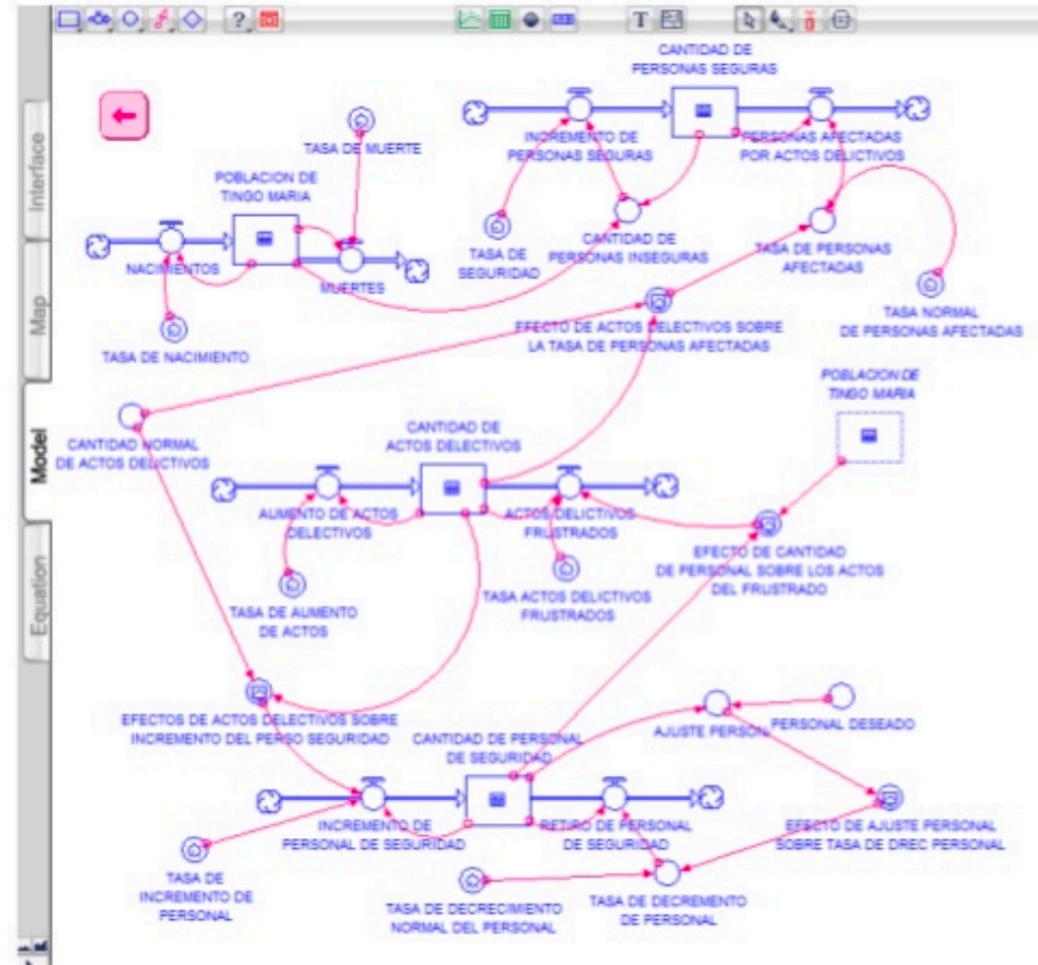
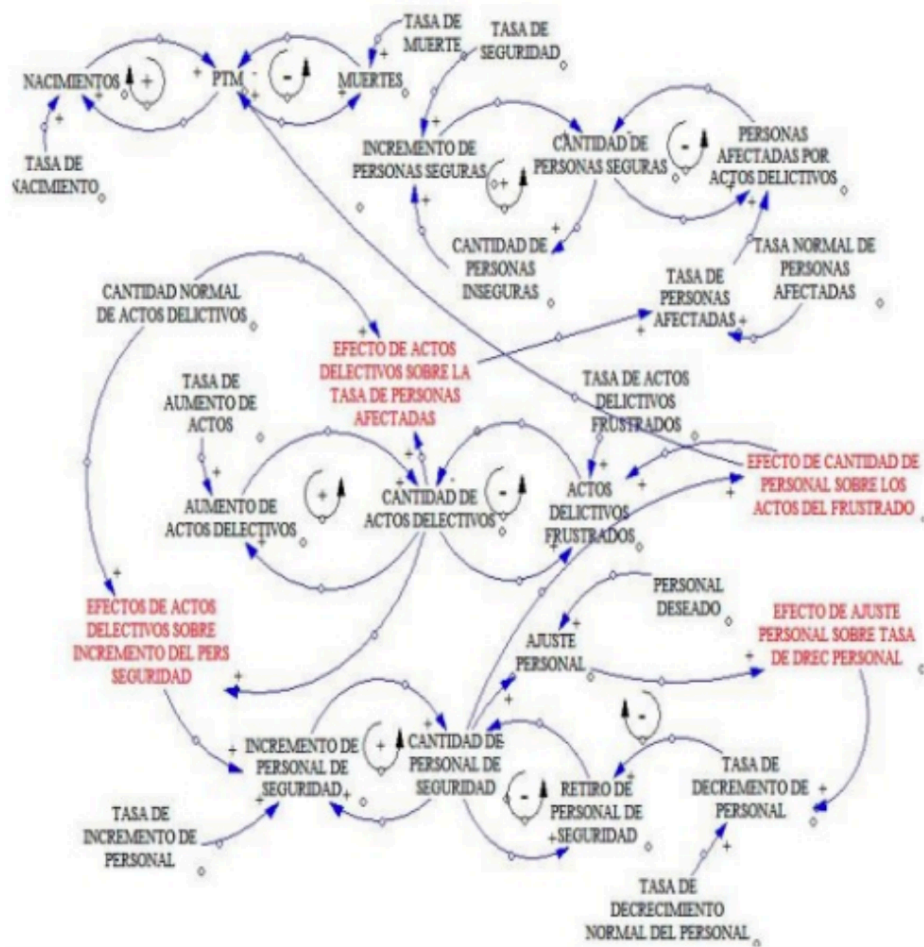
# 1- Conceptos Generales: Complejidad y problemas complejos



<p><b>COMPLEJO</b></p> <ul style="list-style-type: none"> <li>• Impredecibilidad de resultados</li> <li>• Sistemas humanos (subjetividad)</li> <li>• Gestión de patrones</li> <li>• Innovación, creatividad</li> <li>• Pensamiento sistémico y de diseño</li> <li>• Soluciones emergentes</li> <li>• 'Probar – Sense – Responder'</li> </ul>	<p><b>COMPLICADO</b></p> <ul style="list-style-type: none"> <li>• Relaciones causa-efecto no tan evidentes</li> <li>• No existe una solución o respuesta única para cada problema</li> <li>• Detectado el problema → expertos y/o consultores</li> <li>• Reingeniería de procesos</li> <li>• Protocolos de 'buenas prácticas'</li> <li>• 'Sense – Analizar – Responder'</li> </ul>
<p><b>CAOS</b></p> <ul style="list-style-type: none"> <li>• No perceptibles relaciones causa-efecto</li> <li>• Intervención orientada a 'estabilidad'</li> <li>• Gestión de crisis</li> <li>• 'Actuar – Sense – Responder'</li> </ul>	<p><b>SIMPLE</b></p> <ul style="list-style-type: none"> <li>• Relaciones causa-efecto evidentes para todos</li> <li>• Existe una respuesta correcta para cada situación</li> <li>• Mundo de las recetas ('How To')</li> <li>• Automatización de tareas</li> <li>• Mejores Prácticas, soluciones estándar</li> <li>• 'Sense – Categorizar – Responder'</li> </ul>

Cada tipo de Sistema requiere en consecuencia, una caja de herramientas específica.  
Inspirados en modelos lineales; no-lineales; mecánica de probabilidad, o modelos cuánticos

# 1- Conceptos Generales: caja de herramientas - dinamica de sistemas



Ej: Jaen, S. & Dyer, I. (ns). POLÍTICAS SOSTENIBLES PARA LA PREVENCIÓN Y LA DISMINUCIÓN DE LA CRIMINALIDAD EN COLOMBIA. II Encuentro Colombiano de Dinámica de Sistemas. UNAL - Medellín

# 1- Conceptos Generales: caja de herramientas - Analisis de Redes Sociales

## THE POWER OF WEAK TIES

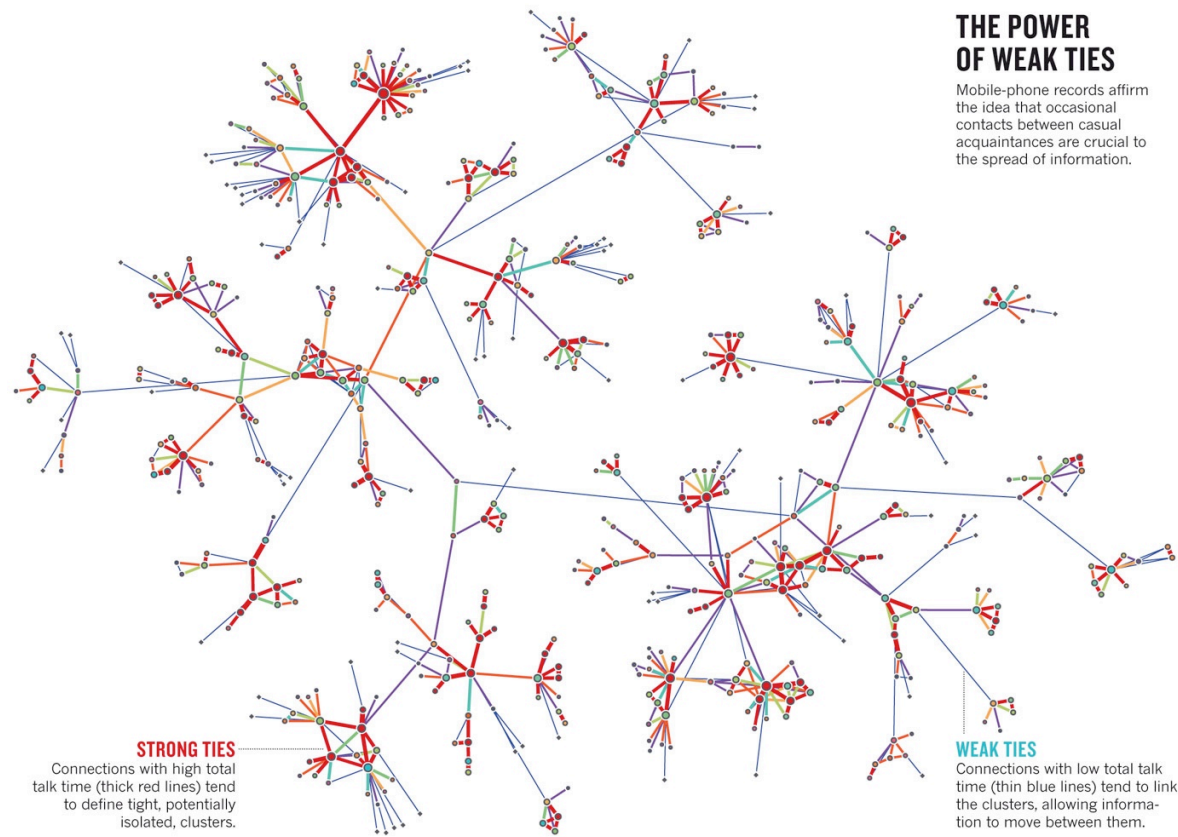
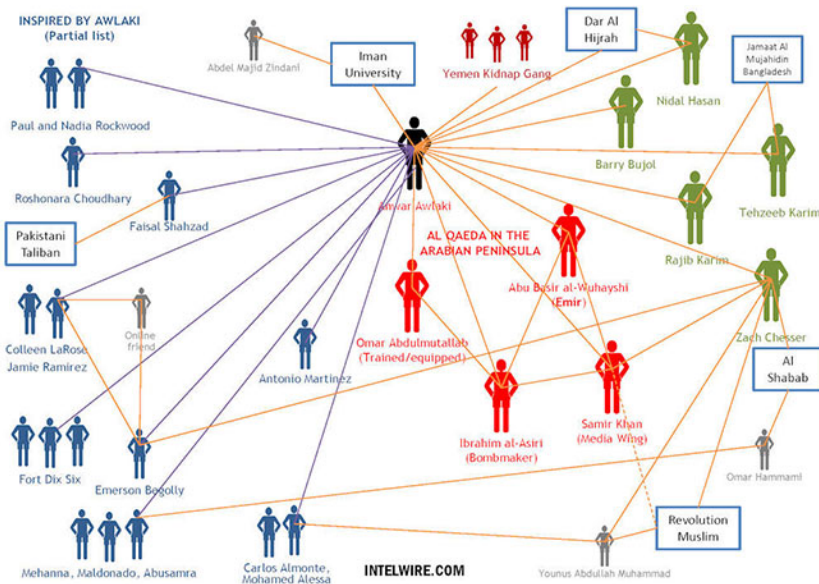
Mobile-phone records affirm the idea that occasional contacts between casual acquaintances are crucial to the spread of information.

### WEAK TIES

Connections with low total talk time (thin blue lines) tend to link the clusters, allowing information to move between them.

### STRONG TIES

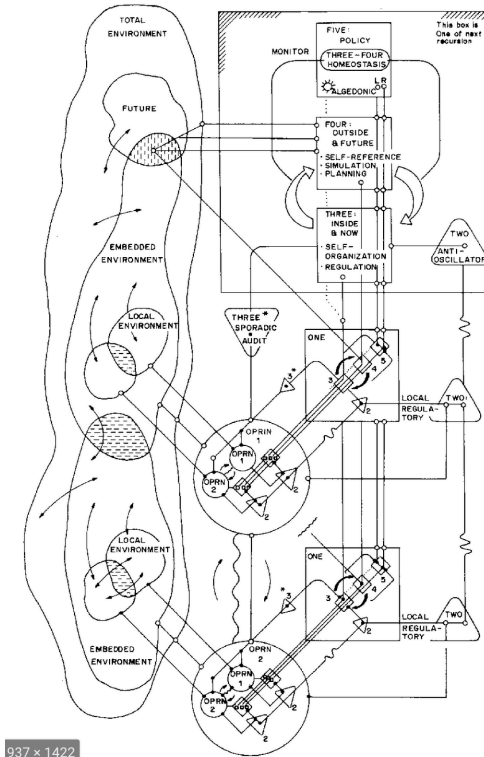
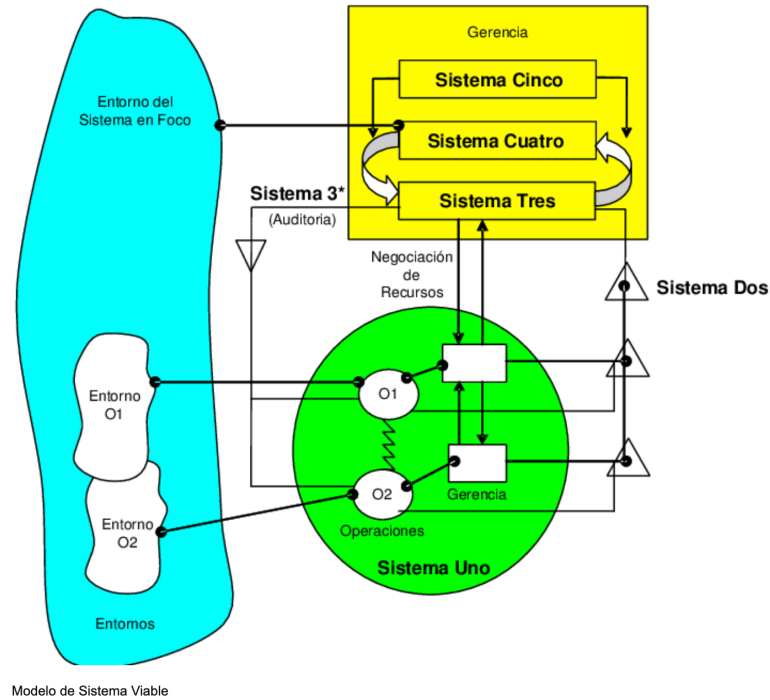
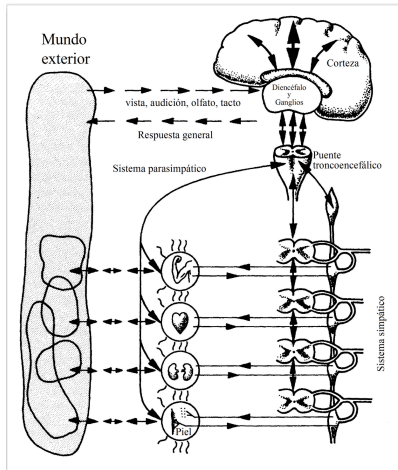
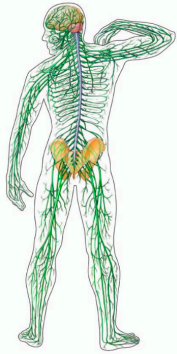
Connections with high total talk time (thick red lines) tend to define tight, potentially isolated, clusters.



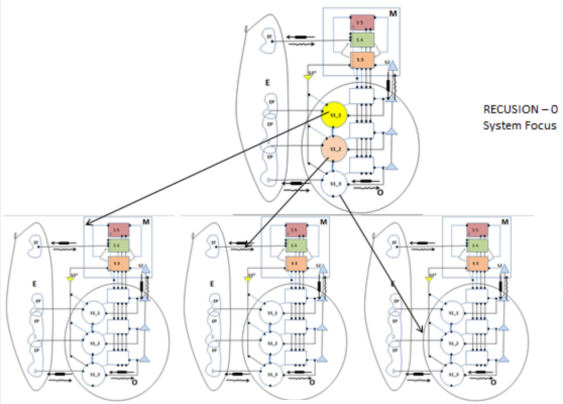
En general se analiza el tipo de enlace y la posición de los nodos en la red

# 1- Conceptos Generales: caja de herramientas - Modelo de Sistema Viable

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937 x 1422



- Todo Sistema viable contiene/contenido en un Sistema viable
- Solo la complejidad puede asimilar complejidad

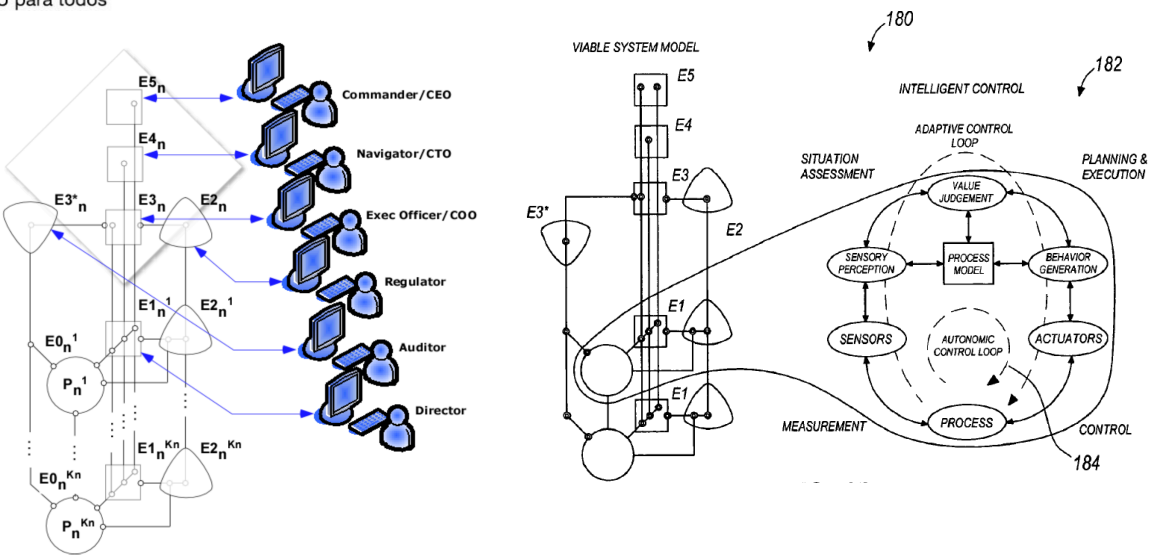


OppsRoom  
Cybersin - Chile (70's)  
<https://99percentinvisible.org/episode/project-cybersyn/>



## 2- Ejemplos de aplicacion – VSM y disenno de sistemas de defensa (Patent: US 7,181,302 B2)

### METACOMAND SYSTEMS - Sistema de Informacion del Departamento de Defensa USA



Label	Services	Roles & Responsibilities
E5	Command	Mission Goals & Objectives, Policy & Command Authority
E4	Analysis/Planning	Modeling, Situation Assessment & Plan Generation
E3	Operations	Plan Execution & Capability Management
E3*	Audit	Program & Process Performance Assessment
E2	Regulation	Plan (Task) & Resource Synchronization
E1	Direction	Plan (Task) Execution Management
E0/P	Process	Embedded [Value] Production Process

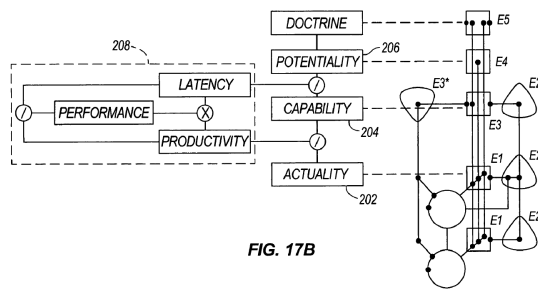
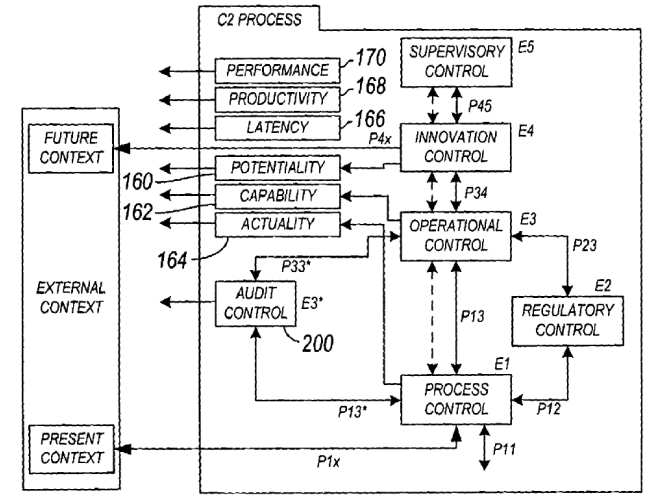


FIG. 17B

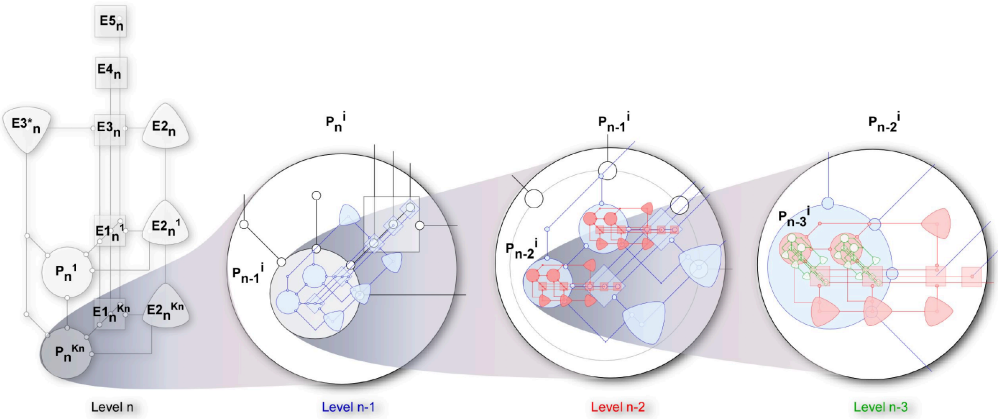
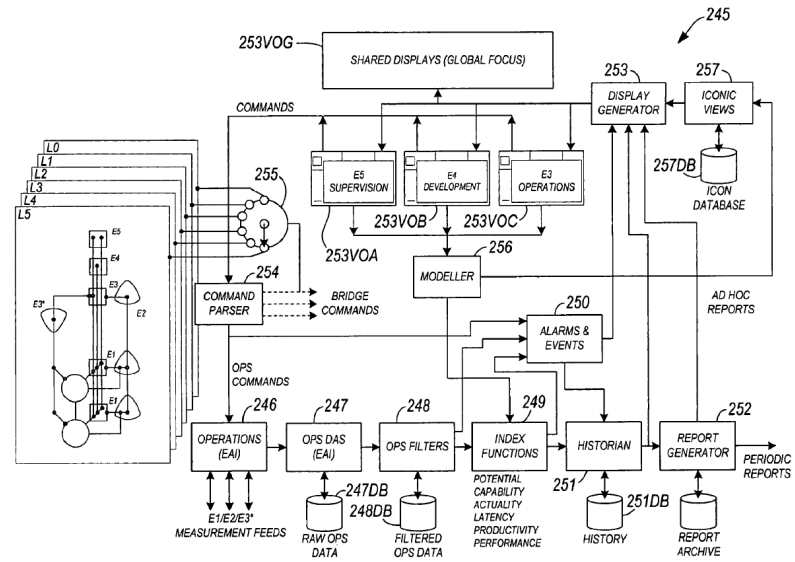


Fig. 6 – Command Axis Recursion (nested accountability hierarchy)



## 2- Ejemplos de aplicacion – VSM y Sistemas de Defensa Total

(En desarrollo/ revision)

Uso de VSM para evaluar la viabilidad y resiliencia de Los Sistemas de Defensa Total de UK Y Noruega.

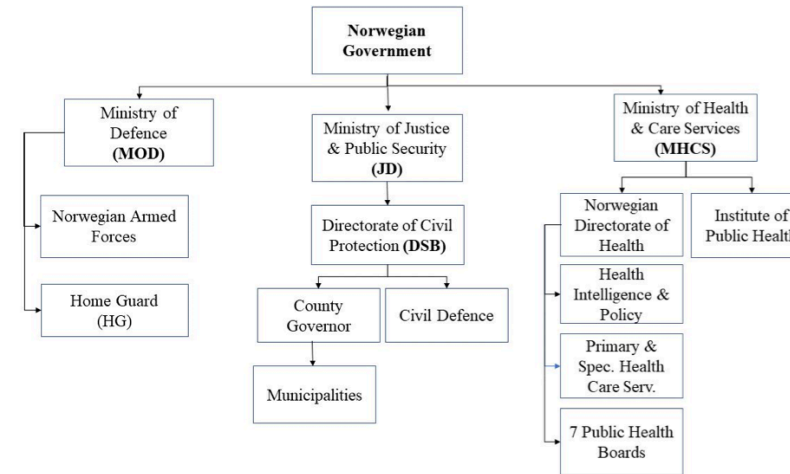


Figure 3 Norway Crisis Response Structure for COVID-19

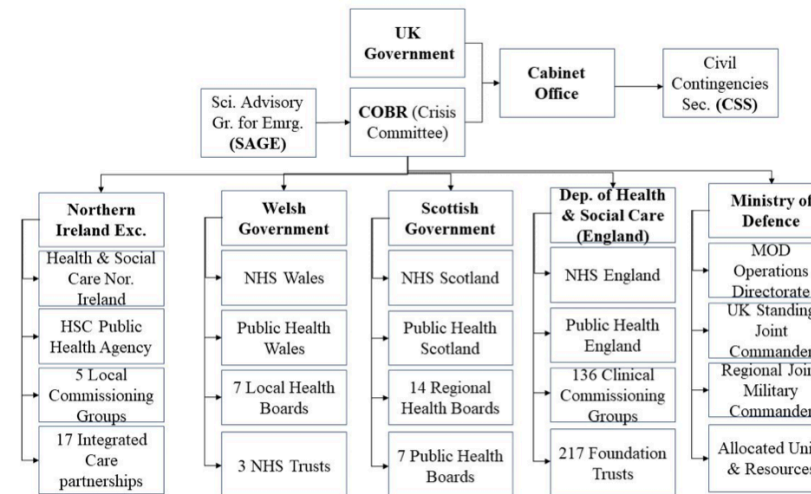
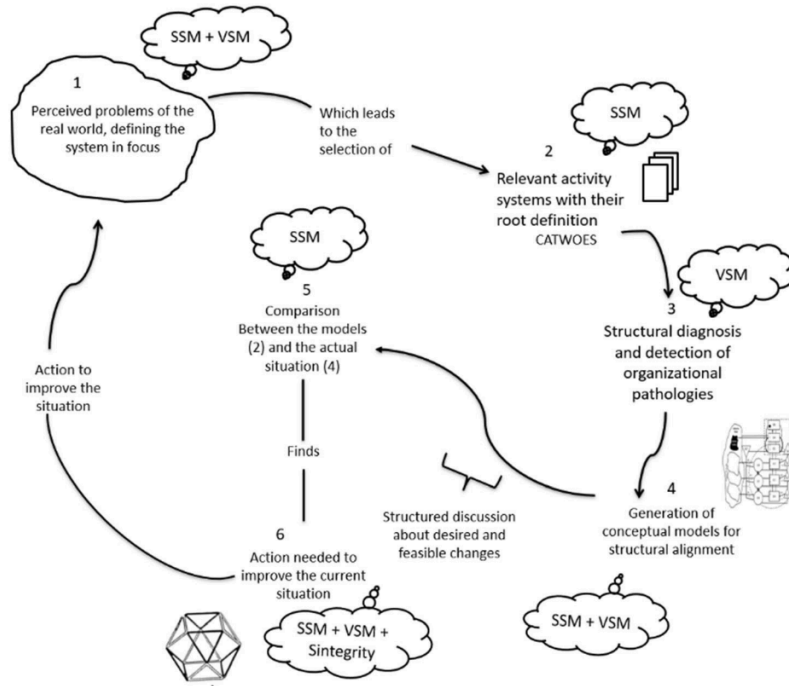


Figure 4 The UK Crisis Response Structure for COVID-19

## 2- Ejemplos de aplicacion – VSM y gestion de riesgo (desastres)

Pexton, M. (Ongoing). COVID 19 Response - Leeds City Council. DBA project



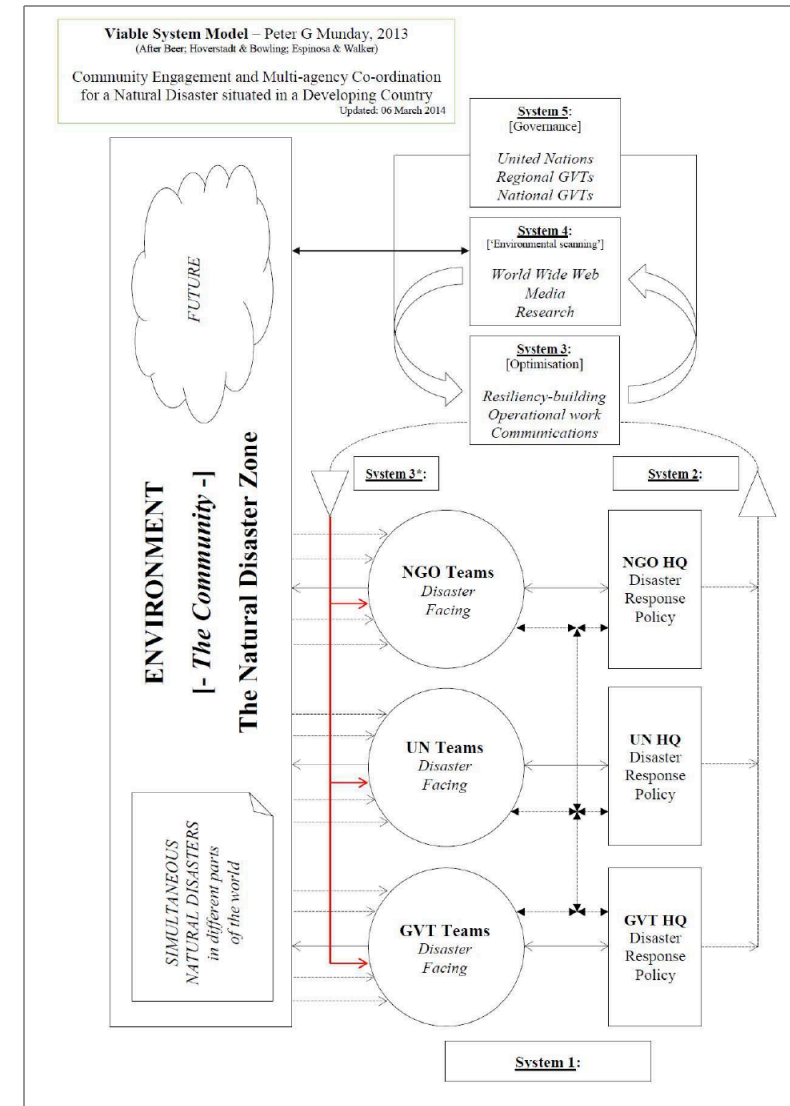
Shawn et al. (2020). Peer Review – Disaster Risk Reduction - Viable System Review

Inpirada en metologias diagnosticas del VSM - ayuda a definir:

- Como
- Donde Investigar, para evaluar sistemas de atencion de desastres
- Que

(VSM – Sistema foco, arquitectura de viabilidad, Comunicaciones)

Graham, P. (2015). Developing a Systems Approach for Multi-Agency Co-ordination and Community Engagement in Disaster Recovery. University of Hull.

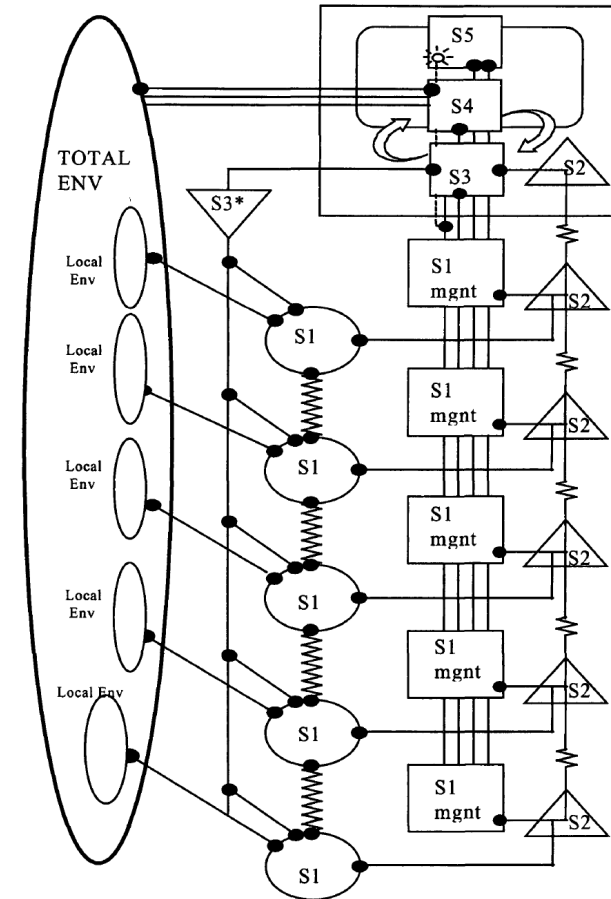


## 2- Ejemplos de aplicacion – VSM Ofensiva

Hutchinson et al (2002). Information warfare. VSM as a framework to attack organizations.

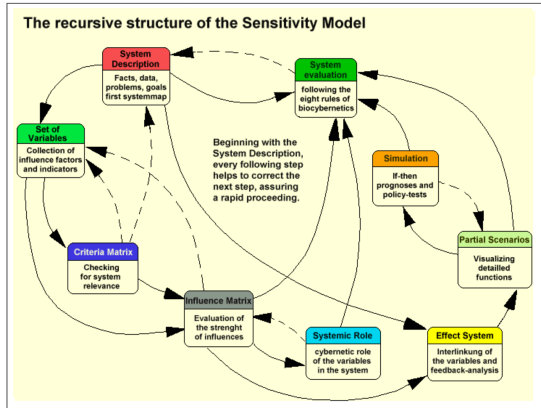
ATTACK TACTIC	COMMENTS
Compromised trusted user	Most software attacks and computer crimes are carried out by trusted users.
Acquisition of user's password	Can be achieved by packet sniffers, and password crackers.
Trojan Horses	Installed after penetration. Mimic actions of system utilities. Useful for sabotage, extortion, and blackmail.
Software Bombs	Similar to Trojan Horses. Planted with some mission critical software, and triggered by date/time.
Viruses	Many variations. Almost all computer systems have been infected at some time.
Worms	Replicate themselves and consume system and network resources.

Identifica formas de ataque para cada rol/funcion dentro de la Arquitectura de Comunicaciones de un VSM



## 2- Ejemplos de aplicacion – VSM y gestion de riesgo (desastres)

### DS y seguridad y toma de decisiones (Sensitivity Analysis / Malik)



#### System Description

This step is purely manual: by discussion, brainstorming, notes and records in the group. It provides the basis for the establishment of the variable set and for a preliminary effect system. The proceeding is described in the first chapter of our manual. By clicking the symbols below you get informations about:

- defining the system boundaries
- nature of the influence factors
- meaning of their interdependencies
- sketching a "picture" of the system
- constructing a preliminary effect system

We recommend to write down a summary of your system description in any case in the notes of this system model. Use therefore the button "notes". So these notes can - especially when you are working with different system models - be recalled at every moment to make it possible to get the basic informations at every step of your work.

#### Variable Set

List of variables:

- Degrad. of ozone-layer
- Co2-concentration
- Phytoplankton activity
- Industrial production
- Forest degradation
- Greenhouse effect
- Waste combustion
- Transp.& Traffic volume
- Fossil energy use
- Agriculture production
- Human health
- Ocean level
- Melting of ice shelves
- Global albedo
- Nutrition of mankind
- Climatic changes
- Floods and landslides
- Behav.& consump.changes
- Soil sealing

Description of the variables:

1 Degrad. of ozone layer  
Starting in the south has now spread to the north too. Caused by chemicals and air traffic, causing skin cancer and damages on crop.

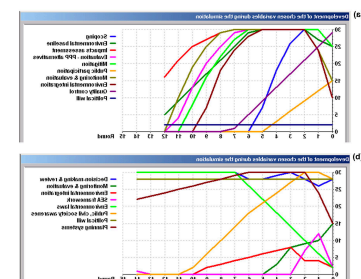
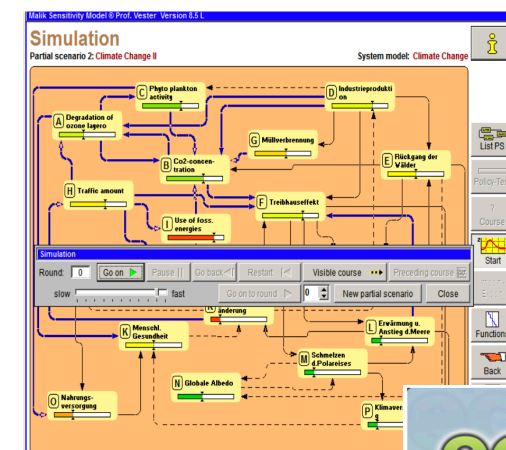
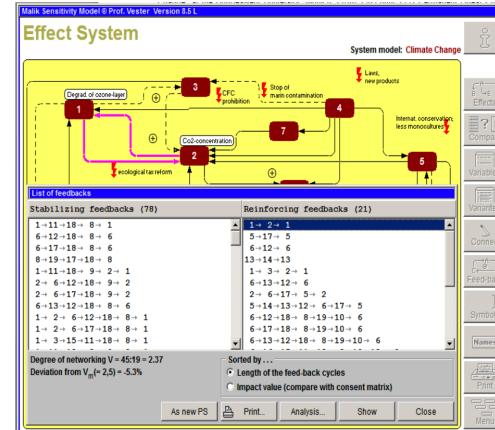
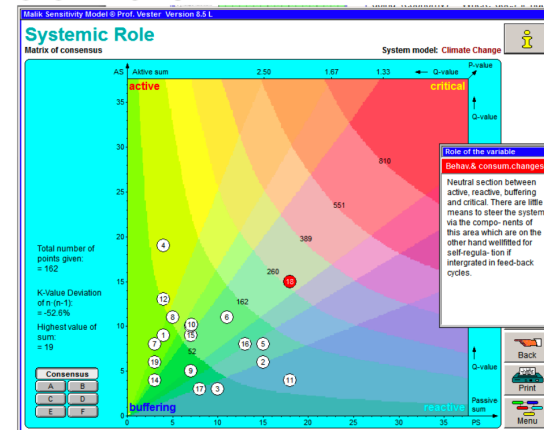
#### Criteria Matrix

Criteria	SPHERES OF LIFE										PHYS. CATEG.		DYN. CATEGORY		SYSTEM RELATIONS			
	Economy	Population	Space utilization	Human ecology	Material balance	Infrastructure	Urban and land	Water	Energy	Information	Transportability	Structural quality	Temporal dynamics	Spatial dynamics	Openness to the world	System tempo to tempo	Influence of outside	Interrelated / isolated
1 Degrad. of ozone-layer																		
2 Co2-concentration																		
3 Phytoplankton activity																		
4 Industrial production																		
5 Forest degradation																		
6 Greenhouse effect																		
7 Waste combustion																		
8 Transp.& Traffic volume																		
9 Fossil energy use																		
10 Agriculture production																		
11 Human health																		
12 Ocean level																		
13 Melting of ice shelves																		
14 Global albedo																		
15 Nutrition of mankind																		
16 Climatic changes																		
17 Floods and landslides																		
18 Behav.& consump.changes																		
19 Soil sealing																		
Sum:	5.0	3.0	7.0	4.0	10.0	4.0	2.0	10.0	8.0	5.0	7.0	7.0	9.0	14.0	8.0	8.0	14.0	5.0

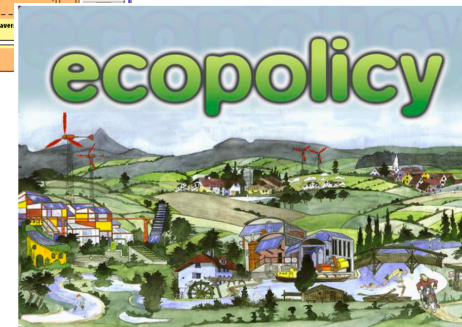
#### Impact Matrix

Matrix of consistencies

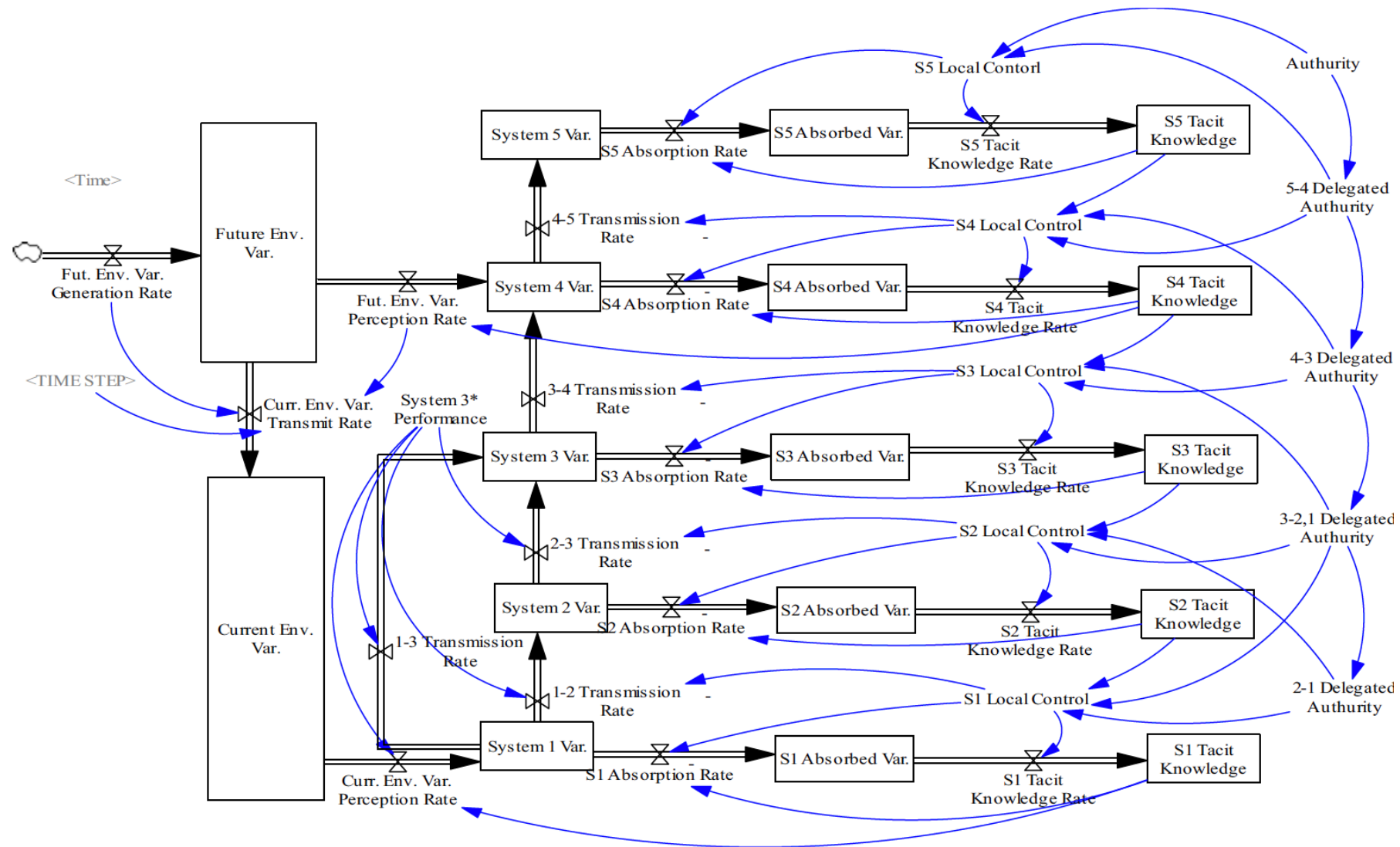
Influence by variable	on variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Degrad. of ozone-layer	X	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Co2-concentration	0	1	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Phytoplankton activity	0	0	0	1	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Industrial production	0	0	0	0	0	1	X	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Forest degradation	0	0	0	0	0	0	0	1	X	0	0	0	0	0	0	0	0	0	0	0
6 Greenhouse effect	0	0	0	0	0	0	0	0	0	1	X	0	0	0	0	0	0	0	0	0
7 Waste combustion	1	2	1	0	1	1	X	0	0	0	0	1	0	0	0	0	0	0	0	0
8 Transp.& Traffic volume	0	2	1	0	1	2	0	X	0	0	0	2	0	0	0	0	0	0	0	1
9 Fossil energy use	0	2	0	0	0	0	0	1	X	0	0	2	0	0	0	0	0	0	0	0
10 Agriculture production	0	1	1	0	2	2	0	0	1	X	0	0	0	0	0	0	0	0	0	0
11 Human health	0	0	0	0	0	0	0	0	0	0	1	X	0	0	0	0	0	0	0	0
12 Ocean level	0	0	1	2	1	1	0	0	0	0	0	0	1	X	0	0	0	0	0	0
13 Melting of ice shelves	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	X	0	0	0	0
14 Global albedo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	X	0	0
15 Nutrition of mankind	0	0	0	0	0	0	0	0	0	0	1	0	2	3	0	0	0	0	1	X
16 Climatic changes	0	0	1	0	2	0	0	0	0	0	1	0	1	0	1	X	0	0	0	0
17 Floods and landslides	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	X	0	0
18 Behav.& consump.changes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	X
19 Soil sealing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Alemania – Irak II  
Canada – 2010  
UK/USA – 2012 – ongoing (?)

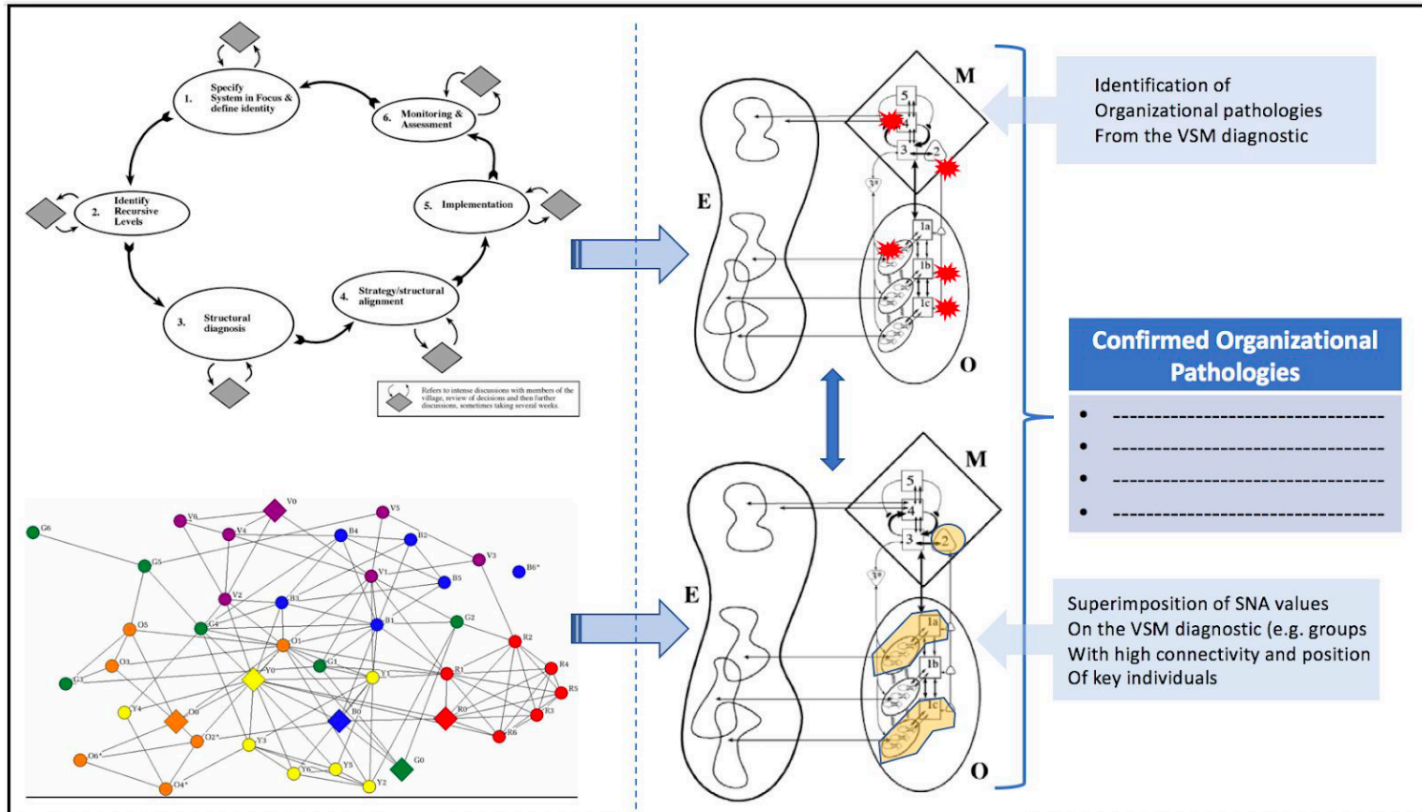


### 3- Nuevos Proyectos – VSM y sistemas dinamicos

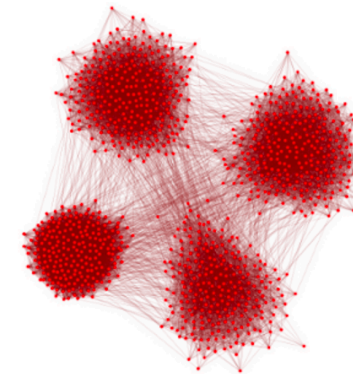


Inicialmente para recrear la idea original de Cybersin - luego explorar aplicaciones en diferentes areas.  
SOLO 2 ARTICULOS PUBLICADOS EN LA LITERATURA DE VSM!!!

### 3- Nuevos Proyectos – VSM y Analisis Avanzado de Redes Sociales



### Integracion VSM con SNA meta-matrices de datos ORA



	People	Knowledge	Tasks
People	Social Network Who knows who	Knowledge Network Who knows what	Assignment Network Who does what
Knowledge		Information Network What informs what	Needs Network What knowledge is needed to do the task
Tasks			Precedence Network Which task must be done before which

**Figure 3. VSM & SNA integration.** From left to right the stages of integration can be observed. Note in the top the VSM process running simultaneously with the SNA (Bottom). Also the SNA capacity to identify key actors and groups - represented by color and shape of nodes.



# Q&A