Living Business Models with System Dynamics: Fast, effective, reliable and useful!

Kim Warren

Simulating business systems and performance was difficult

… but better *method* and *tools* now make it practical

… *easier* than complex and limited spreadsheets

Live, *working*, *quantified* business models

… to *design* the system so it *can* perform well

… and *manage* the system, continually, so it *does* perform well

Go to www.Sysdea.com

Click *Try for free* and create an account (*free for 1 month: then models are retained and can be re-activated*)

Click New Model

Full video User Guide play-list at sdl.re/sygfull (also accessible with a PDF Guide from the software)
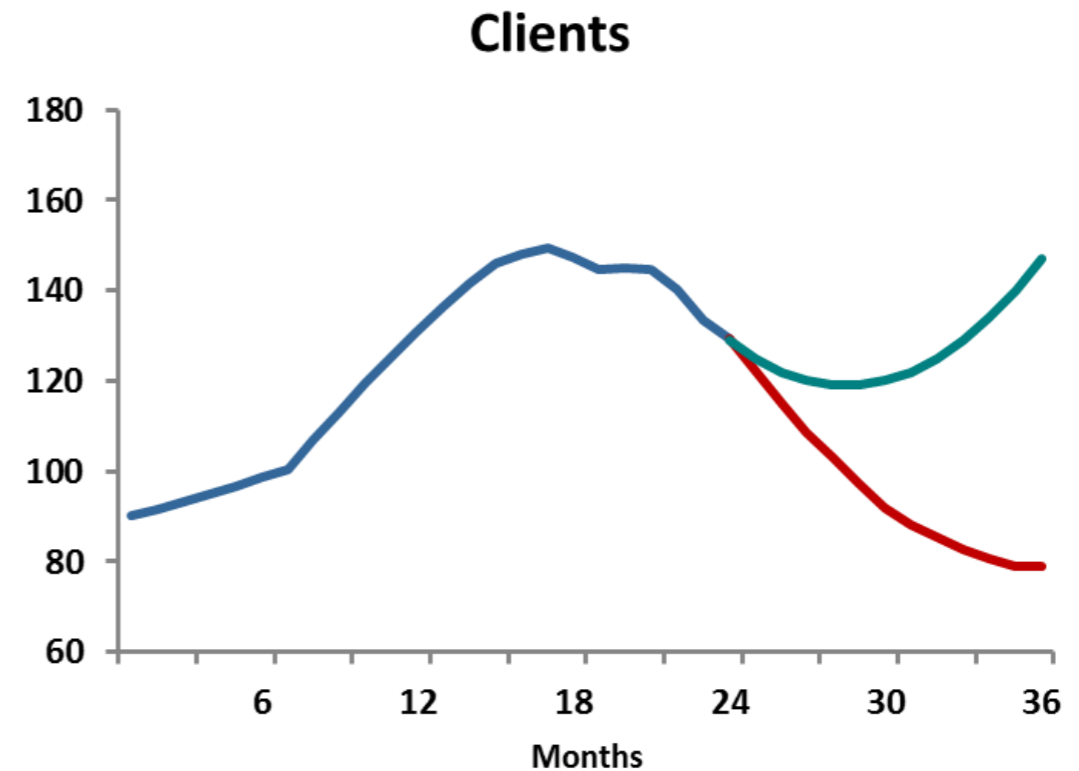
Example: Crisis for an *IT-Support provider*

History …

… new business development executive

… signed up new *clients* fast

… client-support *staff* overloaded

… quality of *support* suffered

… clients *left*, and new ones harder to find

… staff turnover increased

Future risk …

… further *staff* losses

… still-worse *service*

… even more *client losses*

How to turn this around?

Resources drive performance – past, present and future

- in Settings, set the model to run from time 1 to 36

- hit **V** to add a Variable, click to open its Inspector

- name the Variable **problems/month per client**

- set the chart scale to 0 to 4 ... 'sketch' a time-chart rising from ~0.5 to 3

- add a Variable **support quality** and sketch a chart falling from 0.9 to 0.5 then recovering

- drag a link arrow from **support quality** to **problems/month per client**

- Click **problems/month per client** and make its formula (1-"Support quality")*4

- Add a Variable **pressure on staff** and sketch a chart rising from ~0.9 to 1.5, then falling back to ~1.2

- Link this to **support quality** and make *that* formula MIN (0.9, 1 / "Pressure on staff"^2)

- "Today" is month 24 – values 1-24 are actual history, 25-36 are likely future
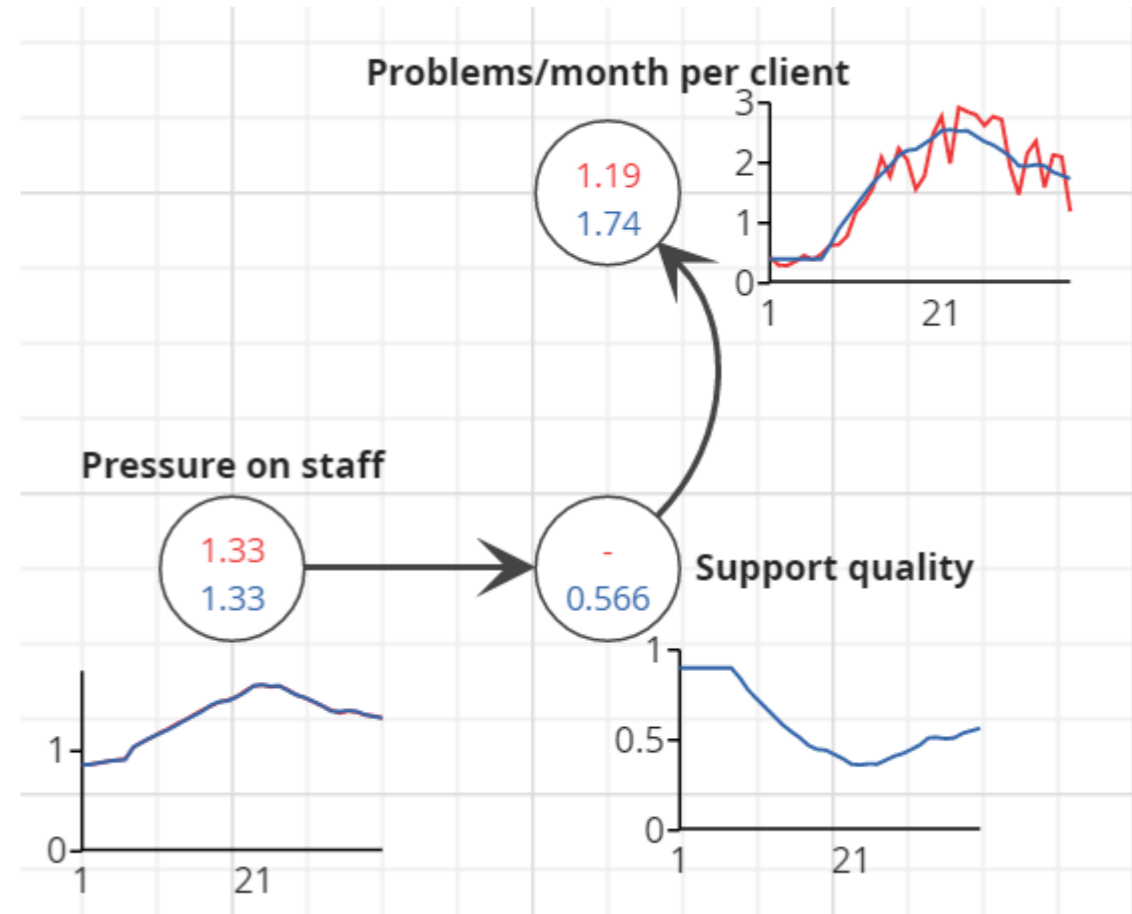
Resources drive performance – past, present and future

- to the left of the workspace click **S** to add a 'Stock' and name it **Clients**

- set the scale 0 to 150 and sketch a time chart like this diagram

- in the Stock's Inspector click '**</>**' to make the Stock behave like a Variable

- add a Variable **support hours/month per client** with a value in its Formula of 70

- add a Variable **total service demand** and link into this **Clients** and **support hours/month per client**

- give **total service demand** a Formula of "Clients"*"Support-hours/month per client"

- Repeat these steps for **Staff** .. **hours/month per person** .. **total staff hours/month**

- Link **service demand** and **staff hours** into **pressure on staff** and make its Formula "Total service demand hours/month"/"Total staff hours/month"

**the dependent variable
we want to explain**

**the independent variables
and causal explanation**
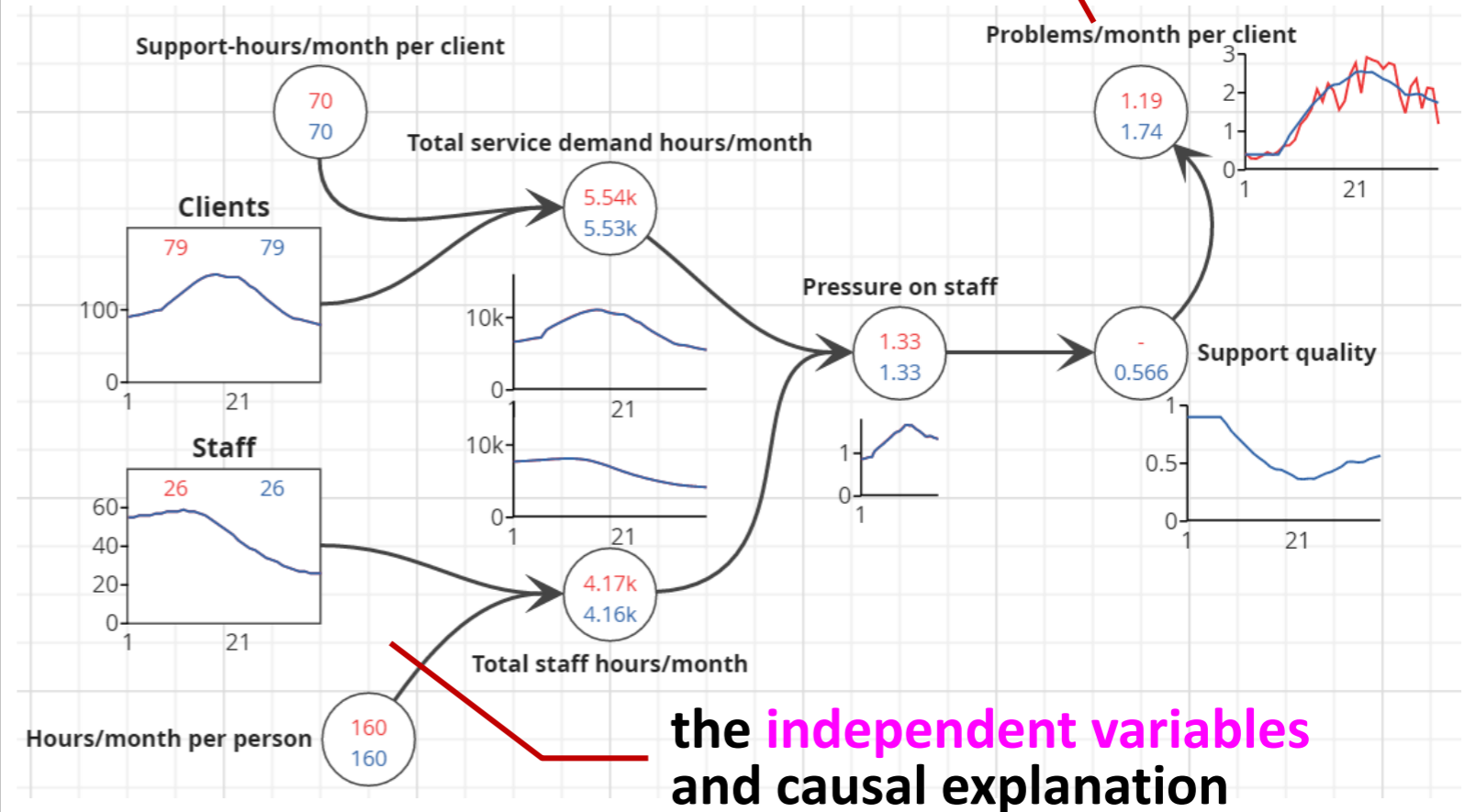
See sdl.re/mfqk (you can save this model if you have a Sysdea account)
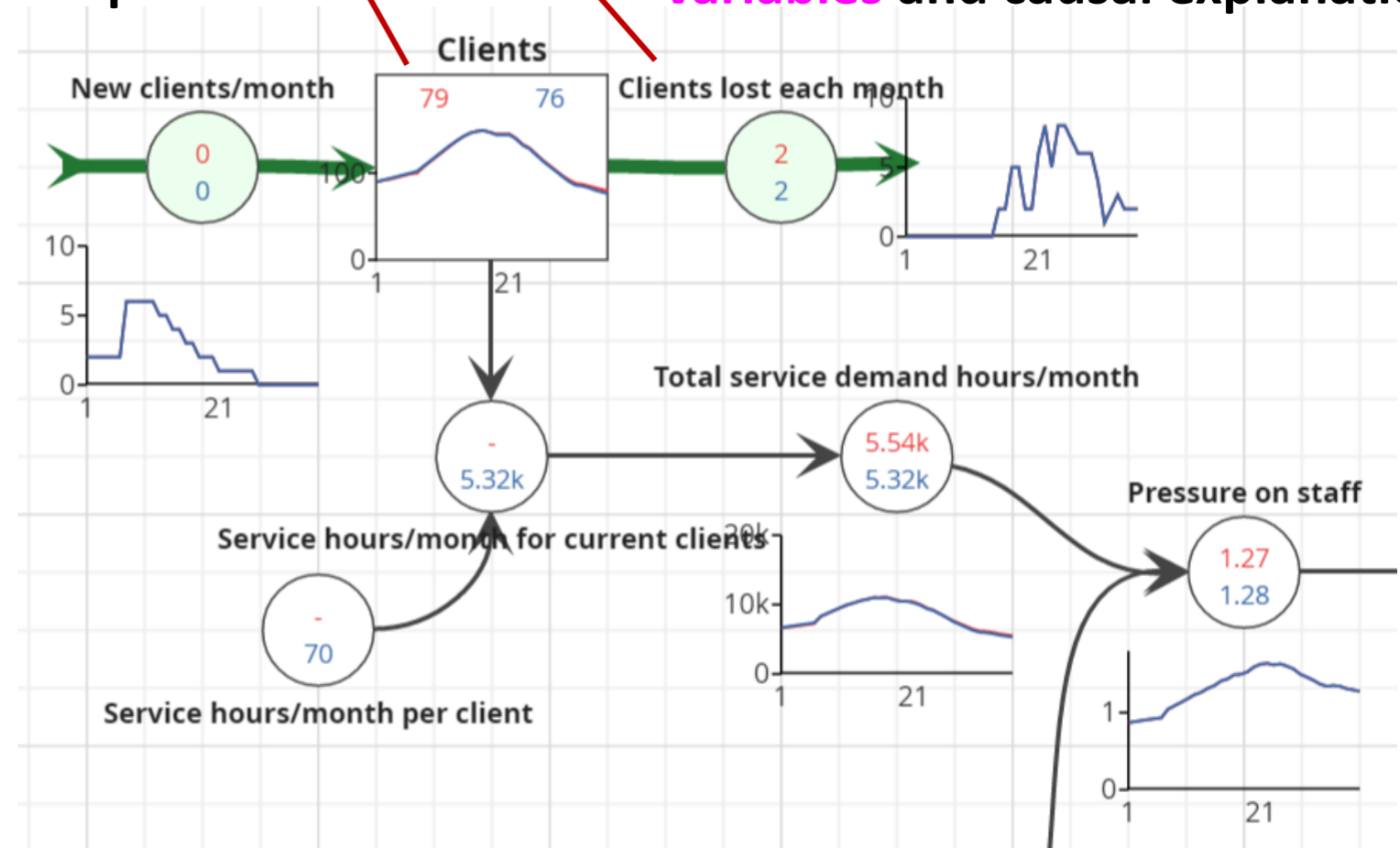
Stocks fill and drain, like water in a tank

the **dependent variable** we want to explain

Flows: the **independent variables** and causal explanation

- move **Clients** above **service hour/month**

- to the left hit **F** to add a 'Flow' **new clients/month** and enter values of 2 for months 1-6, then 6 for 3 months, then falling to 0 by month 24

- drag the 'head' of the flow-arrow to link to the **Clients** stock

- in **Clients** click the '**</>**' button to *stop* the Stock acting like a Variable – it now reflects the flow of **new clients/month** and grows

- to the right, add another Flow **clients lost/month** and sketch a pattern of losses

- drag the 'tail' of the Flow to meet the **Clients** Stock

- adjust the **clients lost/month** Flow until the calculated values for clients roughly match the sketched values

Clients

New clients/month
79   76
Clients lost each month

Total service demand hours/month
5.54k
5.32k

Service hours/month for current clients
5.32k

Pressure on staff
1.27
1.28

Service hours/month per client
70

See sdl.re/mpyr (this includes Flows for staff hiring and staff losses)

What drives **resource flow-rates** … the new dependent variables**?**

Our decisions

External factors

Existing resources

… causing *inter-dependence* **and** *feedback*

… which makes life *difficult***!**

Interdependence and *feedback* drive behaviour

the **new dependent variable** we want to explain

- add a Variable **% clients/month decide to leave**
- add a link *to* this Variable from **problems/month per client** and give it a Formula of MAX (0, ("Problems/month per client"-0.4) *2.5)
- and a link *from* **% clients/month decide to leave** to the Flow **clients lost/month** and make its Formula delay ("% of clients/month decide to leave",5) * "Clients"/100
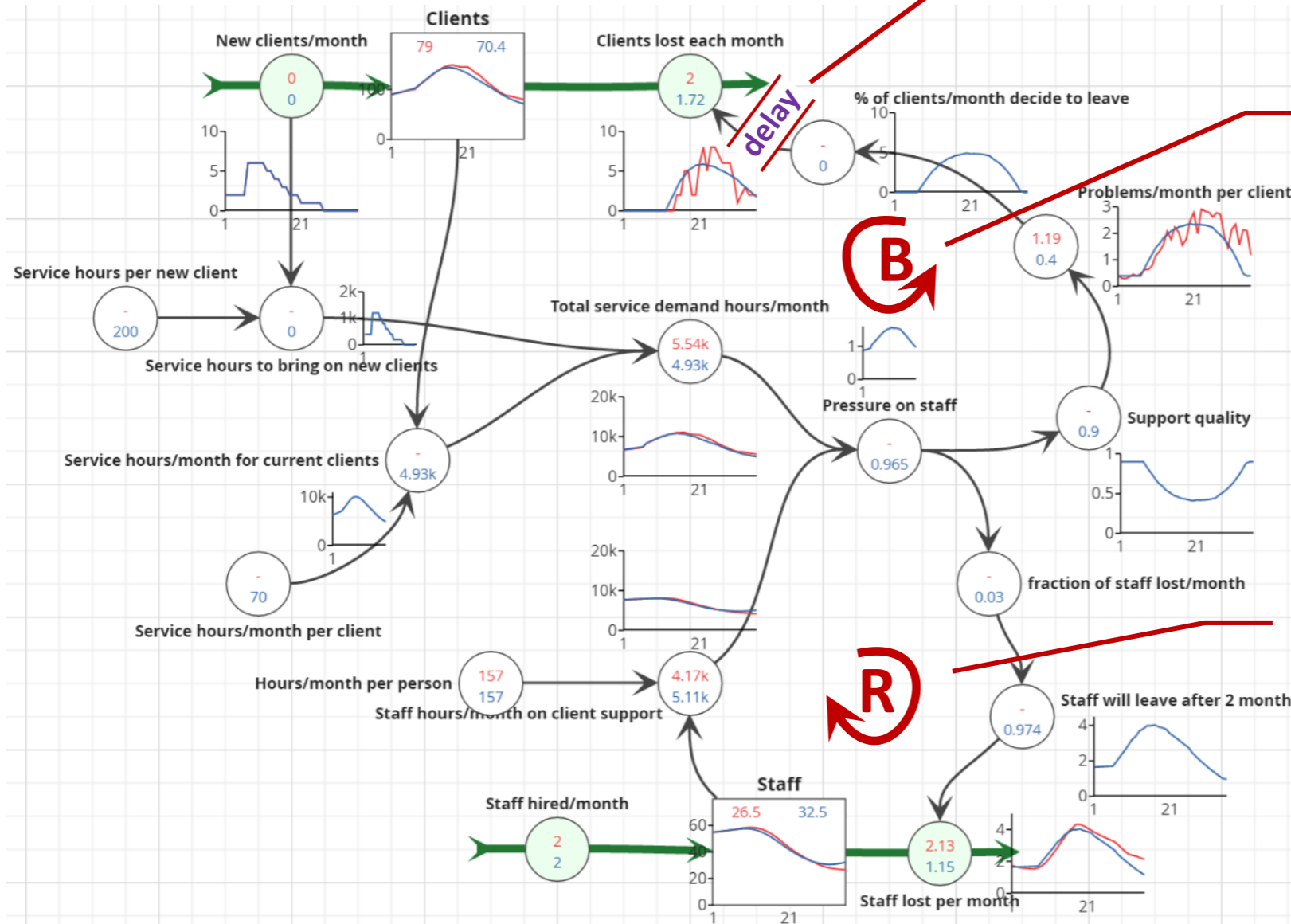
See sdl.re/msny (this includes feedback driving staff losses)

the **next part** of the causal explanation
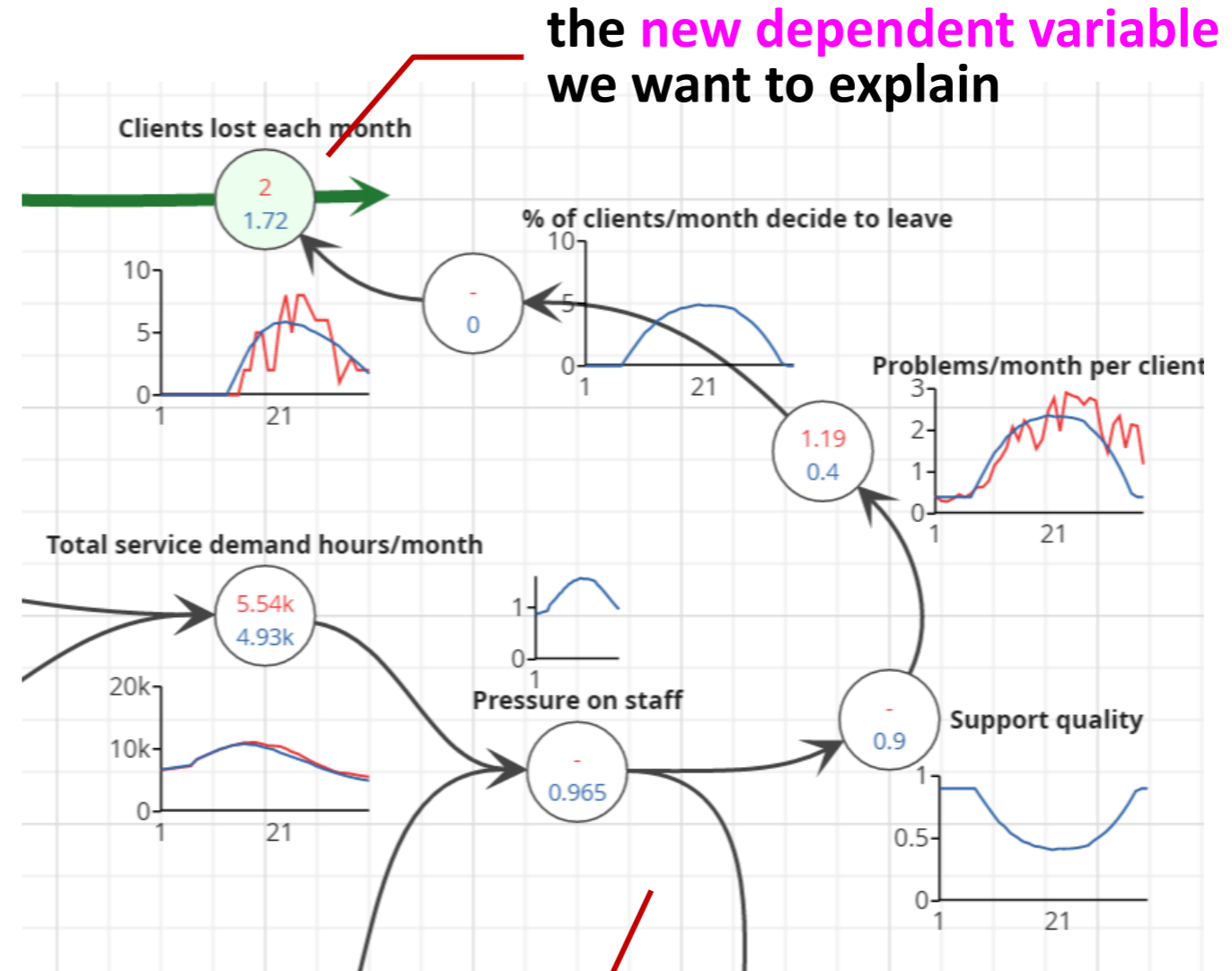
When a Stock drives *its own* flows … *feedback!!*
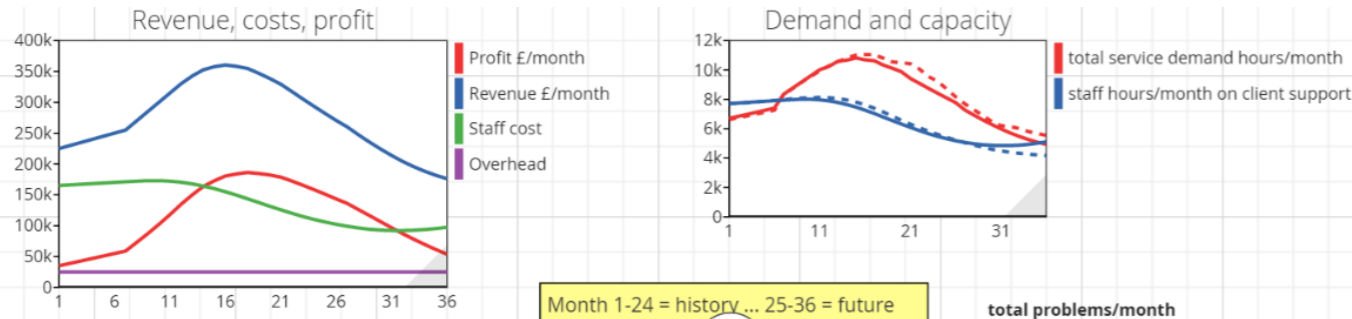

delays cause over-shoot

"B" = balancing feedback, limiting growth

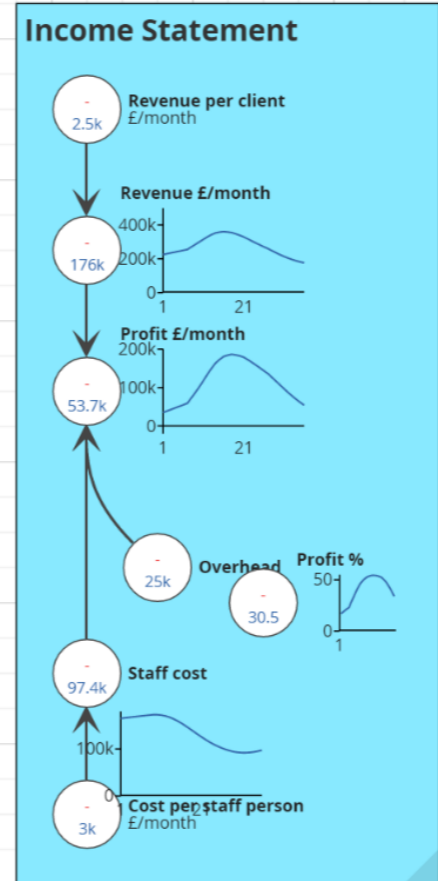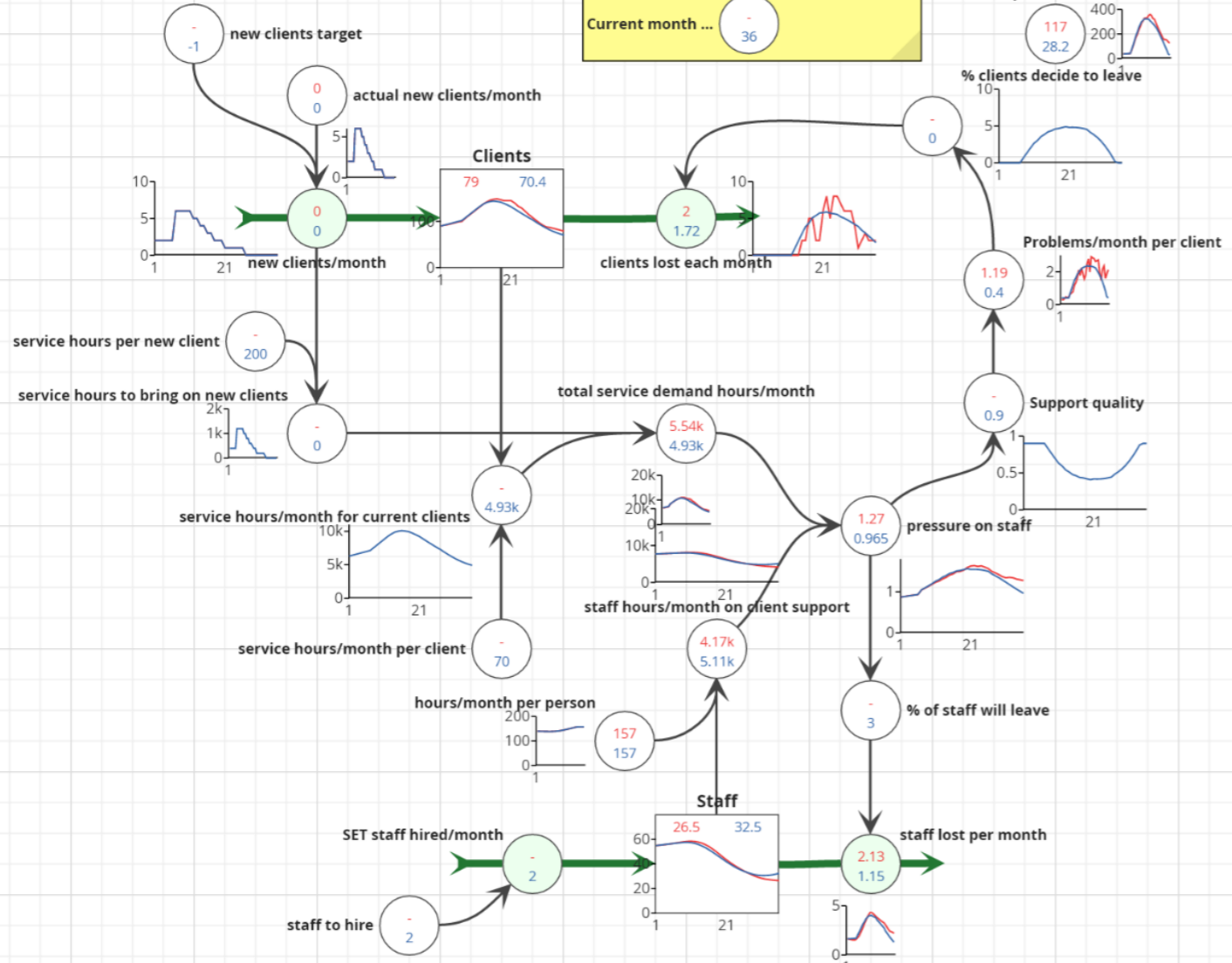**"R"** = reinforcing feedback, driving growth or, in this case, decline

The full IT-support model, including financials

See sdl.re/ITsupport

With a friend … go to sdl.re/ITsupport

At bottom of screen …

Click

Add Comparison Run

36
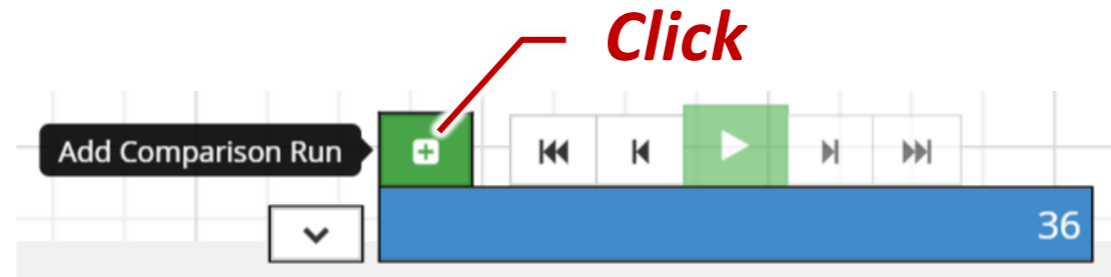
You will see …

DO NOT CHANGE

new clients target	-1
staff to hire	2

1

36

1. set 'staff to hire'

2. step to next month … repeat

3. back to start … try again

What is the *smallest* growth of staff to *never lose clients*?
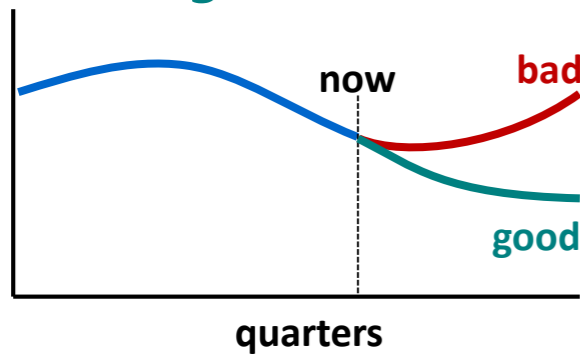What *profit* do you make at the end?

Dynamic challenges
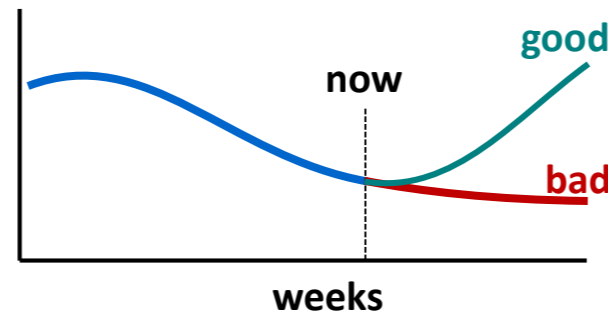
These cases have in common ... *a history*

... the situation could get **worse**

... and will take *time to improve*
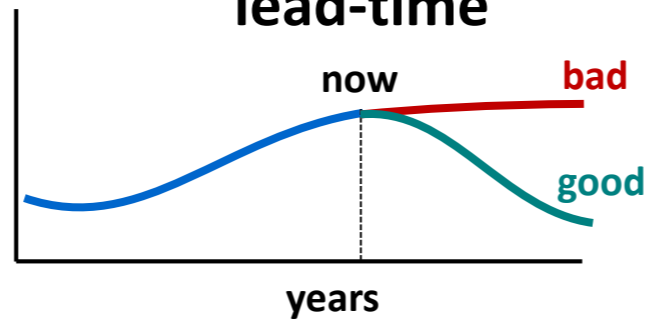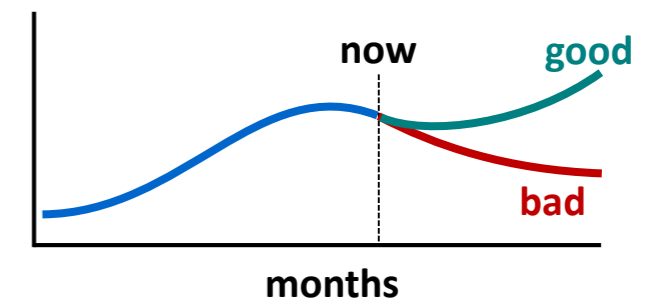
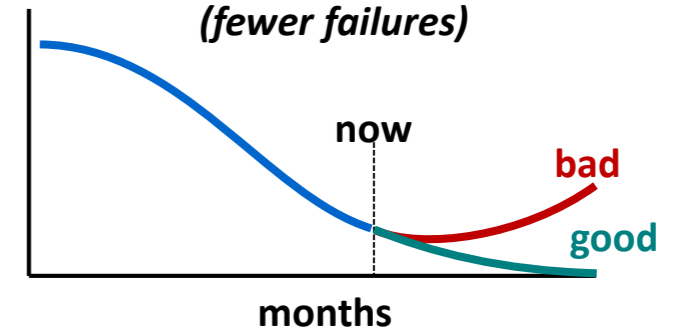# Summary of the generic architecture
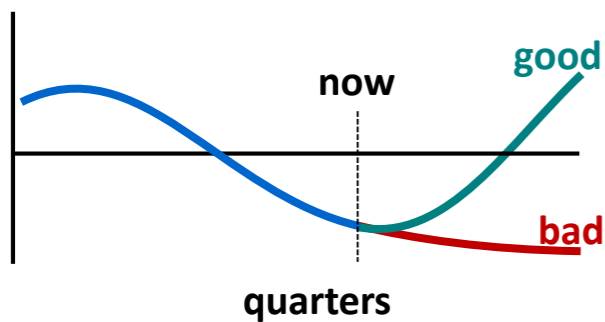
develop

Products

hire

Staff

expand

Capacity

Customers

marketing

Supply/Demand + quality

price

Sales

Revenue

Costs

Profit
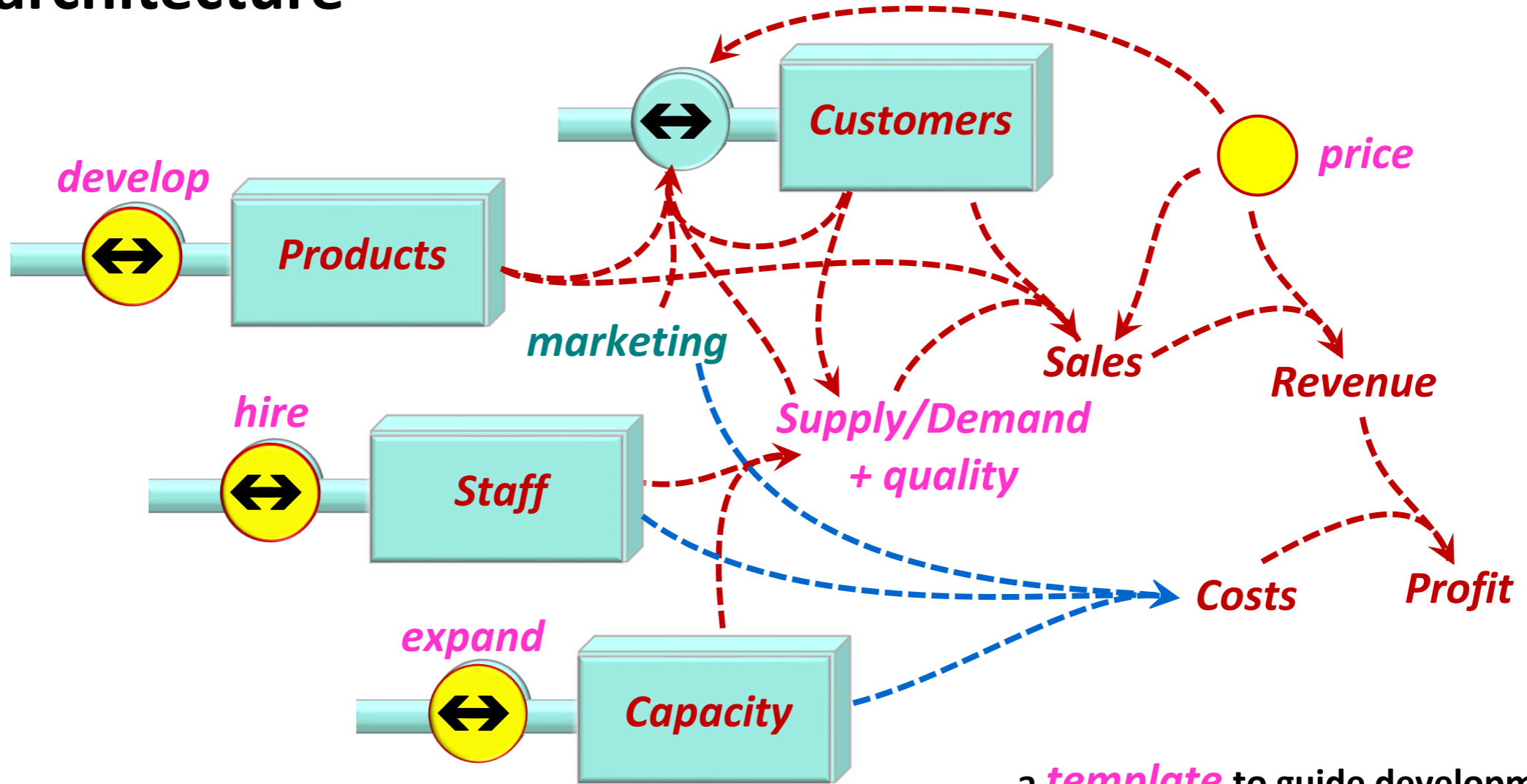
… a *template* to guide development of a core strategy model for many organisations.

Adding to the *core strategic architecture*

The *quality* (attributes) of resources: class 5

How resources *develop* through stages: class 6

Competition for resources: class 7

Policy to steer the system: class 8
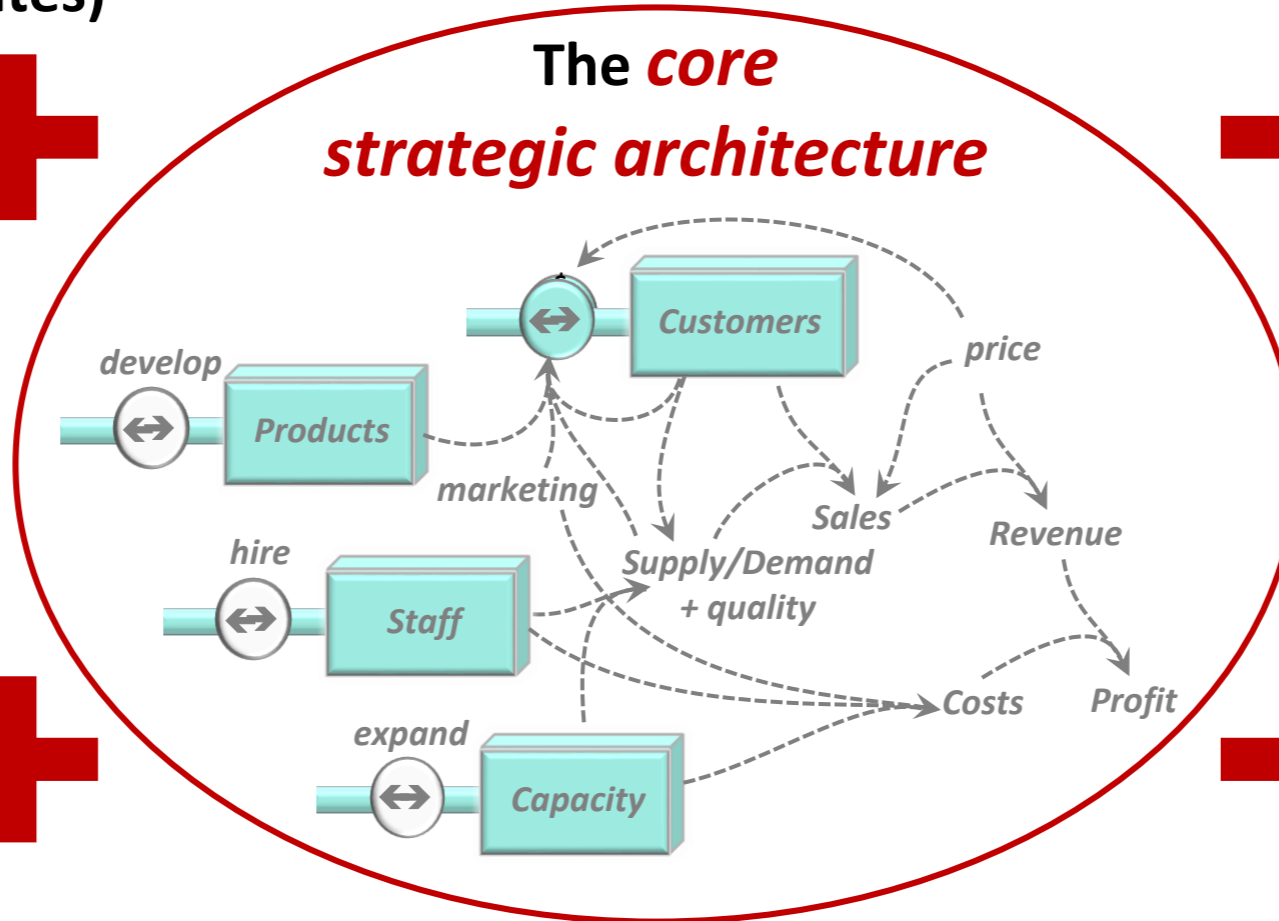
Intangible factors: class 9

Capabilities: class 10

The *core strategic architecture*

develop

Products

marketing

Customers

price

Sales

Revenue

hire

Staff

Supply/Demand + quality

Costs

Profit

expand

Capacity

Each is useful *on its own*, *and*

as *part* of the whole architecture

Example 2: *Ballast-water treatment systems*

Coming regulations require ships to *remove organisms* from ballast water.

Filtration + UV solution ➜

> **Treatment technology type and symbol**

Mechanical
1. Cyclonic separation (hydrocyclone)
2. Filtration

Chemical treament and biocides
1. Chlorination
2. Chloride dioxide
3. Advanced oxidation
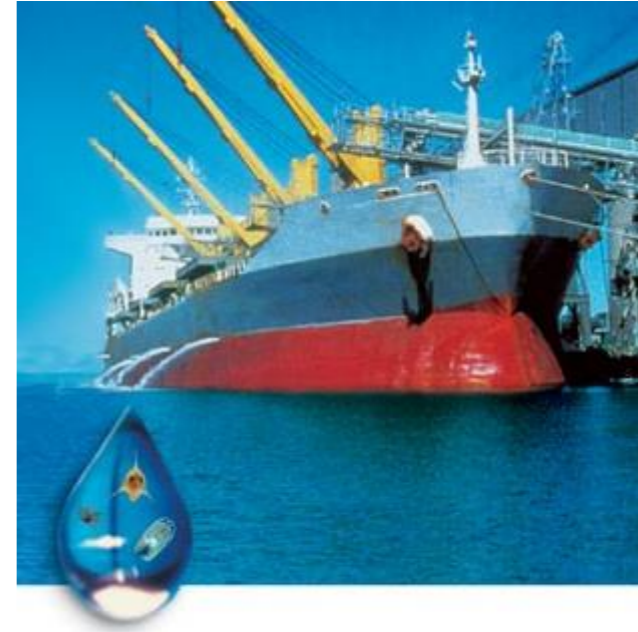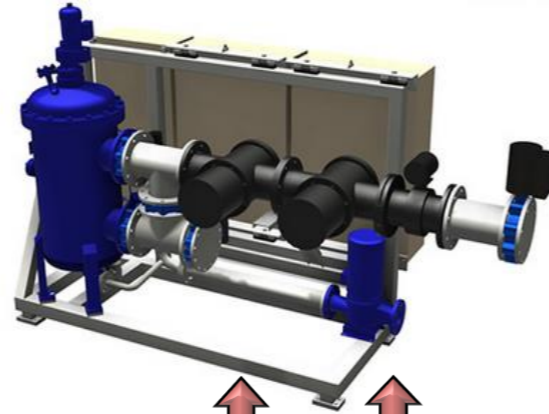4. Residual control (sulphite/bisulphate)
5. Peraclean Ocean

Physical disinfection
1. Coagulation/ flocculation
2. Ultrasound
3. Ultraviolet
4. Heat
5. Cavitation
6. Deoxygenation
7. Electro-chlorination/ electrolysis
8. Electro-catalysis
9. Ozonation`

CIO_2 Treatment System

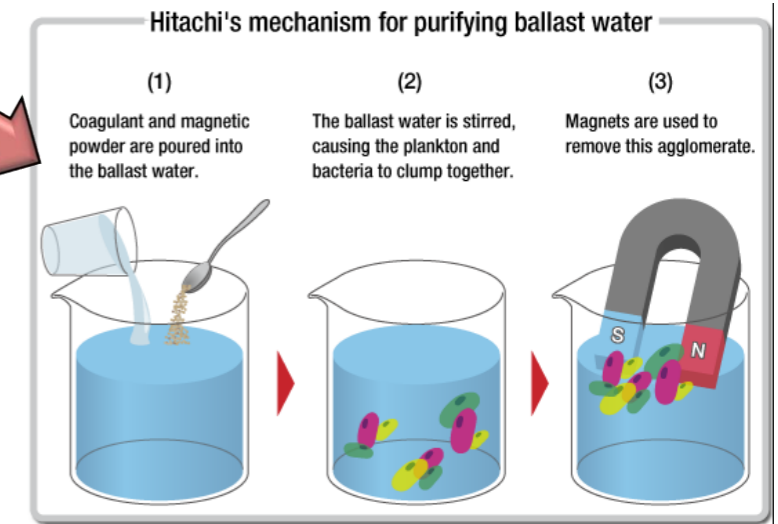Hitachi's mechanism for purifying ballast water

(1) Coagulant and magnetic powder are poured into the ballast water.

(2) The ballast water is stirred, causing the plankton and bacteria to clump together.

(3) Magnets are used to remove this agglomerate.

Example 2: *Ballast-water treatment systems* *

Coming regulations require ships to *remove organisms* from ballast water **

~*35 approved systems* from 50+ suppliers (5-man teams up to Siemens!)

57,000 vessels worldwide + *2-3,000 new builds* per year *minus scrap*

The challenge …

How to capture *ship-operators'* decisions on which system to deploy

… and achieve *rapid installation* in their fleets

plus capture BWT installations in *new vessels*

* with permission of Håvard Gjelseth, CEO: MMC Green Technology

** See International Maritime Organisation: Ballast Water Management

Customer and *product* profile in ballast-water treatment retro-fit systems

Number of vessels	*Companies*
> 100	70
50-99	230
20-49	1,450
10-19	1,550
< 10	>25,000

System throughput	Equipment price	Market potential units
100 m^3/h	€75,000	1,000s
300 m^3/h	€125,000	1,000s
600 m^3/h	€225,000	100s
1000 m^3/h	€365,000	100s
5000 m^3/h	€1,100,000	10's

No supplier can successfully offer all necessary *products*
to serve all *customer segments* and sizes in this industry
… so need to *focus*!

Questions in the *time-phased action-plan* for a Ballast-water treatment system provider

Which size(s) of *vessels* to target?

How many *models* of system to develop, when?

How much effort to win how many *agents* to promote our systems?

How many *sales people* to deploy?

Focus on *new* customers or *repeat sales*?

What *price(s)* to charge on which systems to which sectors?

How many *engineers* to employ? (Production is out-sourced, but need project management and commissioning)
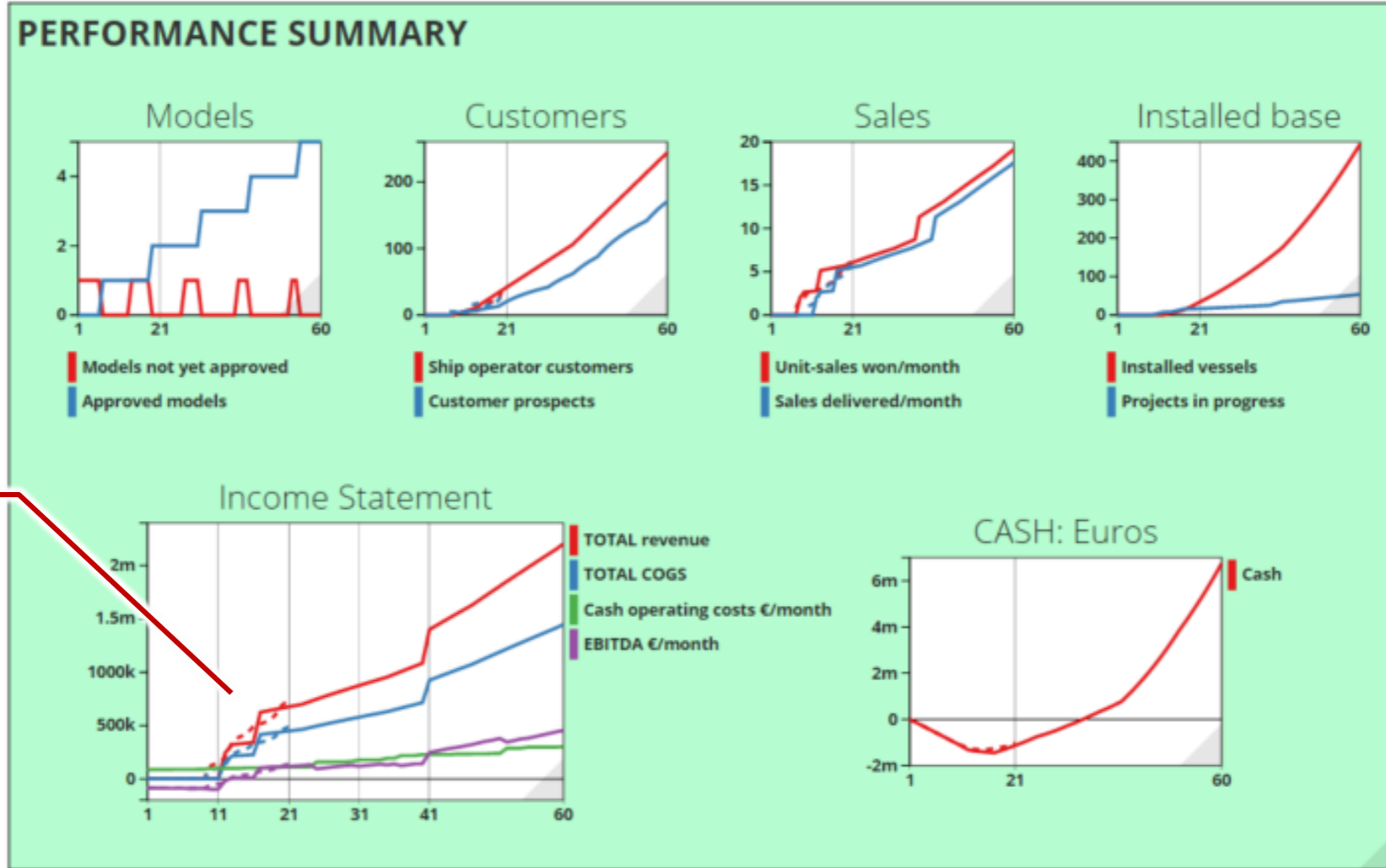
How much *investment* is needed, what *profits* will arise, how will *cash-flow* grow?

All these questions arise continually, as the market and competition develop and as we experience success or failure

BWTS manufacturer *business plan*

months 1-21 history: months 22-60 objectives

PERFORMANCE SUMMARY

Models
- **Models not yet approved**
- **Approved models**

Customers
- **Ship operator customers**
- **Customer prospects**

Sales
- **Unit-sales won/month**
- **Sales delivered/month**

Installed base
- **Installed vessels**
- **Projects in progress**

- - - *dashed* = **actual**
solid = **calculated**

Income Statement
- **TOTAL revenue**
- **TOTAL COGS**
- **Cash operating costs €/month**
- **EBITDA €/month**

CASH: Euros
- **Cash**

The *strategic architecture* of a BWTS producer

sales effect

R&D and system *models*

Agents

Customers and *sales*

price and competition

Income Statement and *cash flow*

Projects, *installations* and *engineers*

See also: sdl.re/BWTcase (Norwegian marine engineering)

See how the method works … sdl.re/sygfull

See also: sdl.re/BWTcase (Norwegian marine engineering)

See how the method works … sdl.re/sygfull

www.strategydynamics.com

www.YouTube.com/strategydynamics

Where next? … integrated operational/strategic models