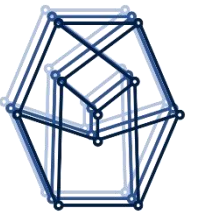


Management Practice

13. Virtual management

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MPiE

24/11/2020

Course

Literature for the course:

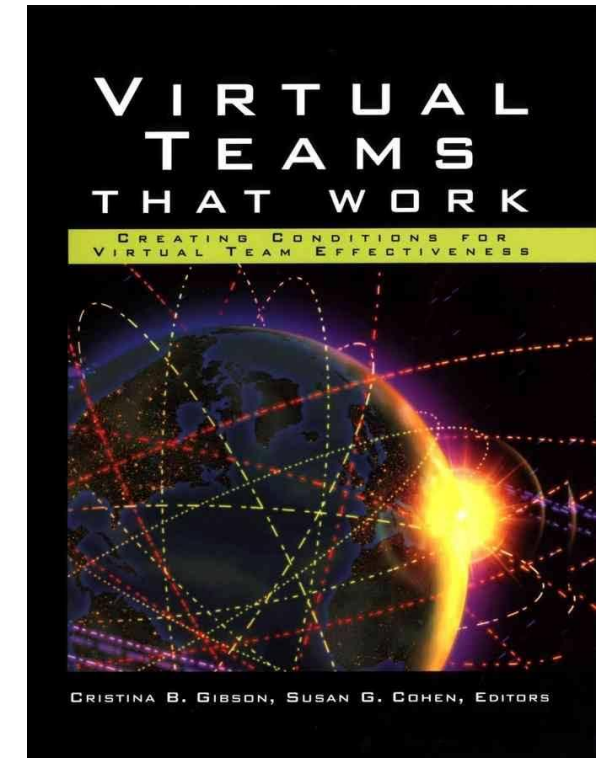
Eisner, Howard. *Essentials of project and systems engineering management*. John Wiley & Sons, 2008.

Learning objective for this session:

- Able to provide a definition for a virtual team
- Understand the main challenges of virtual teams
- Able to describe factors that can help manage a global team
- Able to describe the components of a structural equation model

Literature for this session:

Gibson, Cristina B., and Susan G. Cohen, eds. *Virtual teams that work: Creating conditions for virtual team effectiveness*. John Wiley & Sons, 2003.



Remote working

4.3_{mil}

People working remotely
in the UK

Data from the ONS 2017.

57_{mins}

The average daily commute
in the UK

Data from the ONS 2018.

2+_{hrs}

Is the daily commute for
over 3.7 million people

Data from the ONS 2018.

73%

Workers put in more effort
than is required when
working from home

Research by Cardiff University 2017.

30%

Workers feel their productivity
increases when they work
away from the office

Research by YouGov 2015.

70%

Workers feel it is important for
businesses to allow their
employees to work flexibly

Research by YouGov 2015.



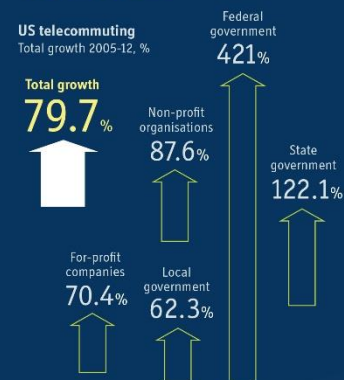
26_{wks}

After six months, an
employee has the legal right
to ask their employer for
flexible working

The Flexible Working Regulations 2014.

The rise of virtual teams

- The use of virtual offices is growing fast ...



- Most US employees now do at least some work out of the office—and prefer to do so (% of workers)



- Multinational companies rely on international teams



But...

- Employees can become isolated
- Team building can suffer
- IT security and legal risks may emerge for employers



- Therefore team building for virtual teams is essential:

Make sure that team members meet physically early on and then meet up regularly to build relationships. Individual tasks should be made clear so that a scattered team is not left chasing a general goal.



Establish a regular, set schedule for communication between team members, set times for calls and, if necessary, guidelines for when to use phone, email and other devices. Ensure that a common language has been agreed upon for teams of different nationalities.



Use reliable, proven technology. Team members must use shared, reliable IT platforms that are easy to access and secure.



Monitor individual performance closely and ensure that team members take responsibility for individual tasks.



Keep team sizes manageable: complex projects can lead to virtual teams of 100 or more people.



Virtual teams

A virtual a team must have the following attributes:

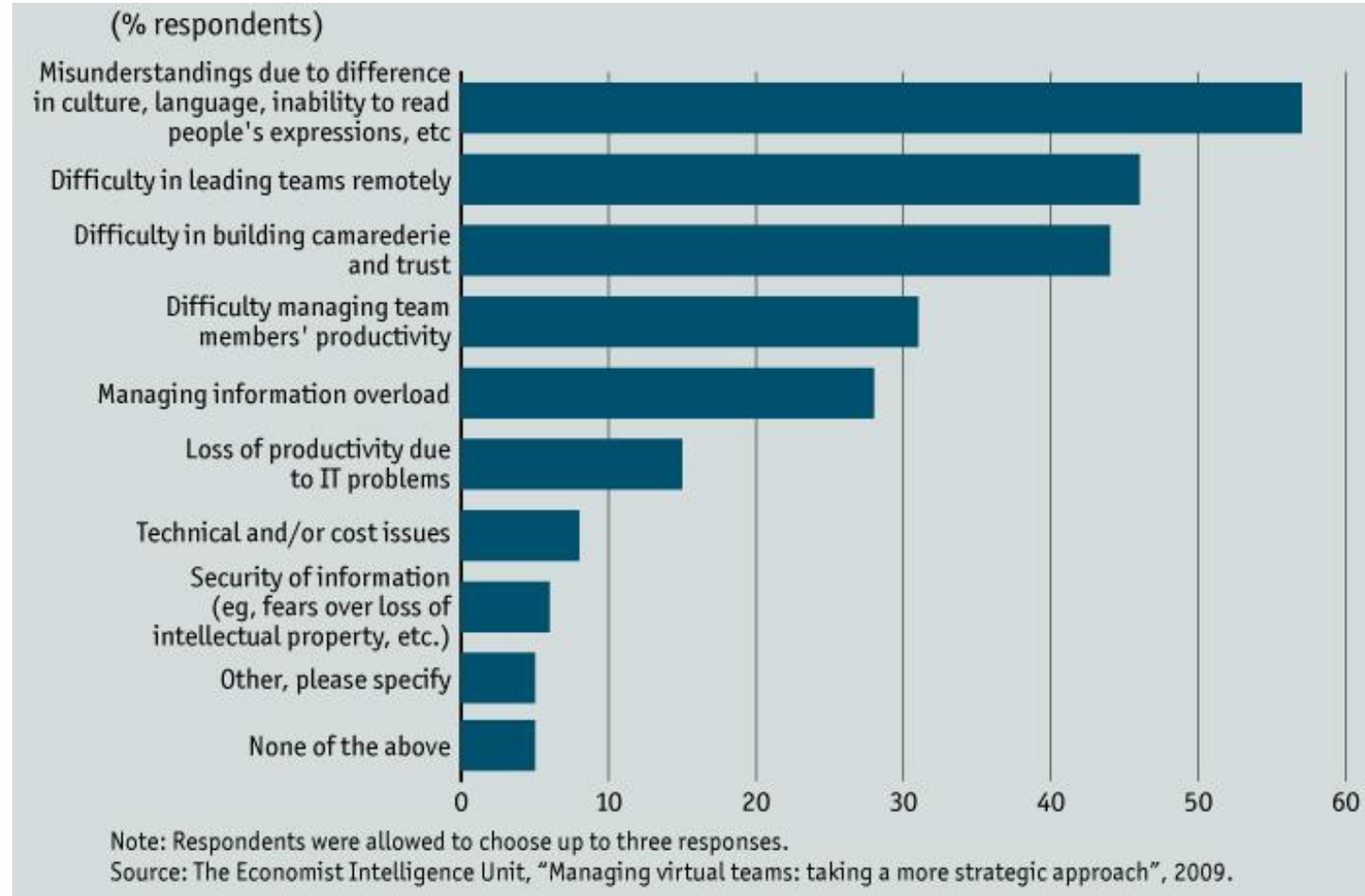
- It is a functioning team—a collection of individuals who are **interdependent** in their tasks, **share responsibility** for outcomes, see themselves and are viewed by others as an **intact social unit** embedded in one or more social systems, and **collectively manage their relationships** across organizational boundaries.
- The members of the team are **geographically dispersed**.
- The team relies on **technology-mediated communications** rather than face-to-face interaction to accomplish their tasks.

Learning networks, communities of practice, Web-based interest groups, and other more loosely formed collectives are not defined as a virtual team.

Issue

- Higher probability for misunderstanding, as a lot of information that is important for successful communication (e.g. non-verbal and para-verbal communication) can be hidden.

Challenges of managing a virtual team

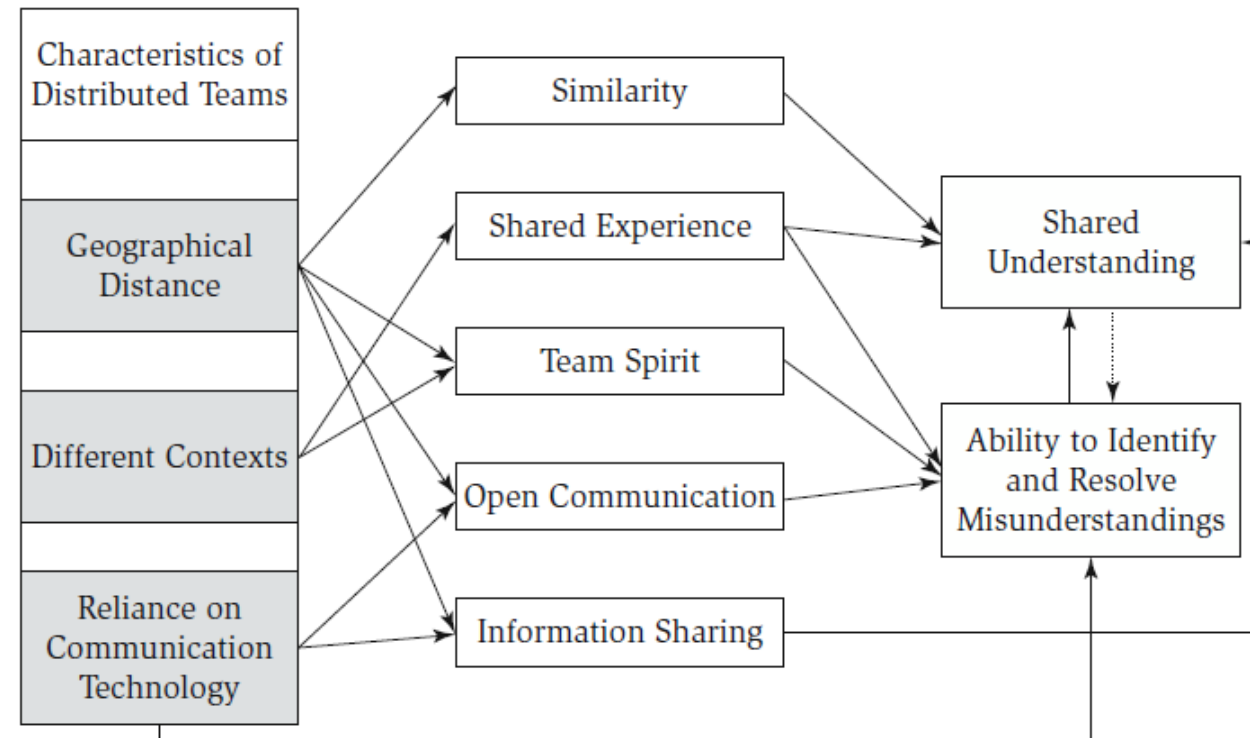


Shared understanding

- Shared understanding—a collective way of organizing relevant knowledge—can have a significant impact on the ability of teams to coordinate work and perform well.
- It provides the following benefits:
 - Enables people to predict the behaviours of team members
 - Facilitates efficient use of resources and effort
 - Reduces implementation problems and errors
 - Increases satisfaction and motivation of team members
 - Reduces frustration and conflict among team members



Effects of Team Characteristics on Shared Understanding



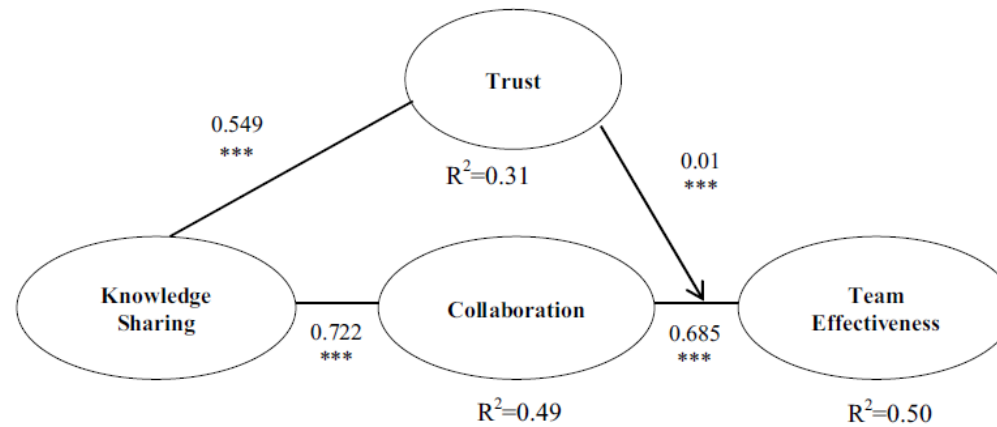
Facilitating shared understanding

- Compose teams in which members have similar backgrounds.
- Highlight and emphasize similarities among team members.
- Facilitate sharing of personal information, especially early in the project.
- Facilitate sharing of information about day-to-day activities throughout the project.
- Identify essential knowledge that is needed on the project, and make sure that this knowledge is shared, especially across sites.
- Encourage face-to-face meetings with team members early in the project and periodically throughout longer, more difficult projects.
- Encourage team members to visit the work locations of other team members.
- Build a strong team identity.
- Keep turnover low.
- Provide easy access to and support for (including training and technical support) videoconferencing and on-line team spaces.



Knowledge sharing

- A study showed the importance of knowledge sharing to virtual team effectiveness, and recommends that organizations support knowledge sharing in virtual settings on both technological and social levels. A PLS (partial least squares) analysis was performed.



Projection to latent structure

Prediction method

- X: Independent variables
- Y: Dependent variables (predict Y from X)

$$Y = f(X)$$

Different options are available to predict Y based on X, but regression-based approaches are often applied.

However, regression-based approaches have several limitations:

- The postulation of a simple model structure
- The assumption that all variables can be considered as observable
- The conjecture that all variables are measured without error, which may limit their applicability in studying complex phenomena's in engineering management.

Prediction

- Structural equation modeling (SEM) allows the simultaneous modeling of relationships among multiple independent and dependent constructs.
- SEM enables the constructing of unobservable variables measured by indicators (also called *items*) as well as to model measurement error for the observed variables.
- To estimate the parameters of an SEM, a covariance-based or variance-based approached can be used. Variance-based SEM is also known under the term partial least squares (PLS) analysis



SEM

- SEM is often described as combining factor analytic and regression models into a single data analysis tool. Using the language of SEM, **latent variables (factors)** represent the concepts of the theory, and data from **measures (indicators)** are used as input for statistical analyses that provide evidence about the **relationships** of the latent variables with their indicators and relationships among the latent variables.
- It is a tool that is often used in management research.

SEM - definitions

- η (eta) = latent endogenous variable (value is determined by the states of other variables in the system)
- ξ (xi) = latent exogenous (i.e., independent) variable
- ζ (zeta) = random disturbance term
- γ (gamma) = path coefficient
- ϕ (phi) = non-causal relationship between two latent exogenous variables
- y_i = indicators of endogenous variables
- ε_i (epsilon) = measurement errors for indicators of endogenous variable
- λ_{yi} (lambda y) = loadings of indicators of endogenous variable
- x_i = indicators of exogenous variable
- δ_i (delta) = measurement errors for indicators of exogenous variable
- λ_{xi} (lambda x) = loadings of indicators of exogenous variable

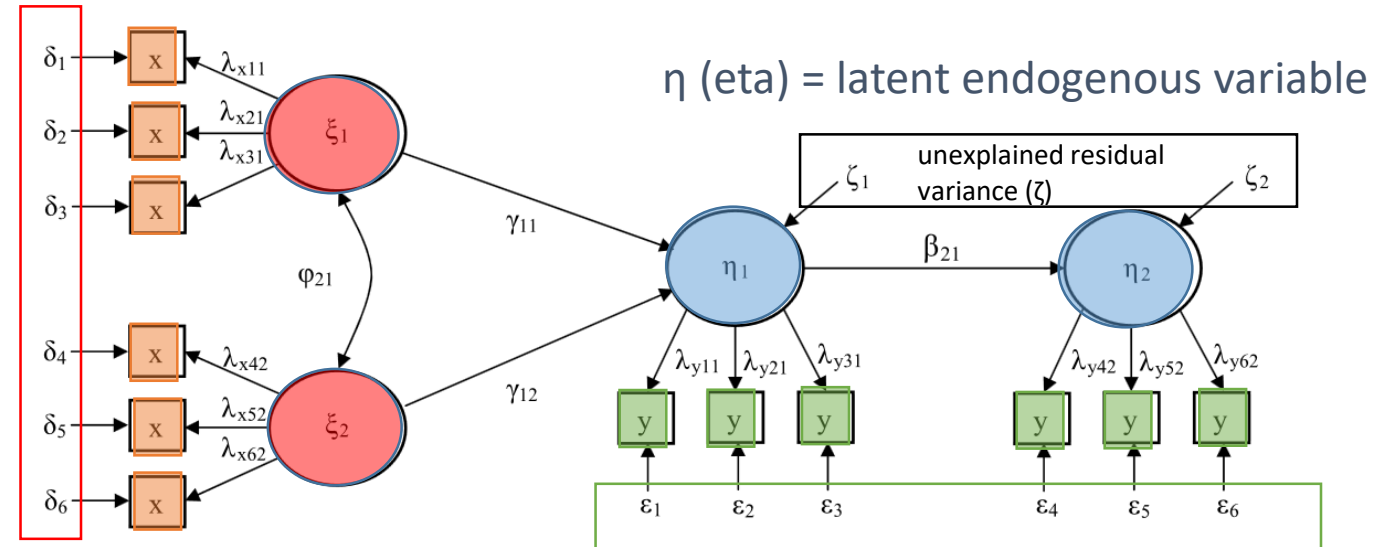
Price of material in a supply chain is **endogenous** because it is set by a producer in response to customer demand.



Example Model

- A circle is used to represent each of four latent variables
- The boxes represent associated indicator variables.
- The relationships between the latent variables and their indicators are often referred to as a measurement model, in that it represents or depicts an assumed process in which an underlying construct determines cause (e.g. response to a questionnaire)

x_i = indicators of exogenous variables



ξ (xi) = latent exogenous (i.e., independent) variable

y_i = indicators of endogenous variables

λ_{yi} (lambda y) = loadings of indicators of endogenous variable

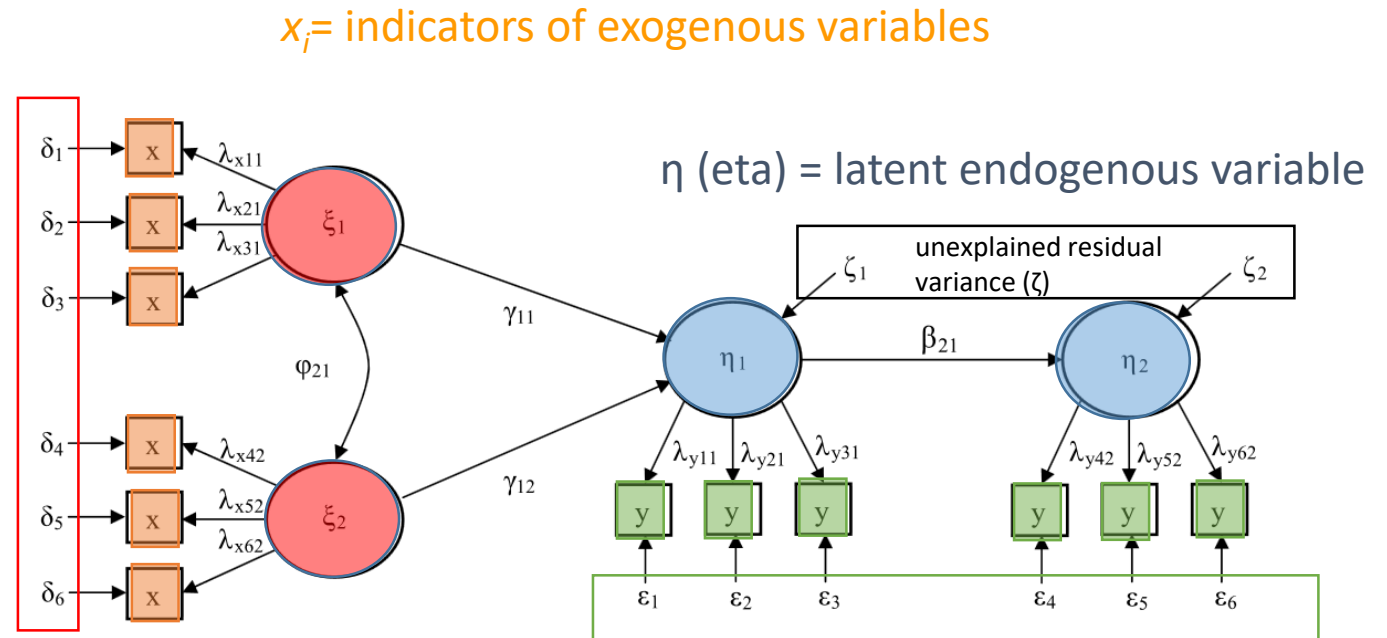
ϵ (epsilon) and δ (delta) are measurement errors

ϕ (phi) is a non-causal relationship between variables

SEM

The first set relates the indicators of the exogenous variables (\mathbf{x}) to their associated measurement error (δ) and the latent exogenous variables (ξ):

$$\begin{aligned} x_1 &= \lambda_{x11} \xi_1 + \delta_1 \\ x_2 &= \lambda_{x21} \xi_1 + \delta_2 \\ x_3 &= \lambda_{x31} \xi_1 + \delta_3 \\ x_4 &= \lambda_{x42} \xi_2 + \delta_4 \\ x_5 &= \lambda_{x52} \xi_2 + \delta_5 \\ x_6 &= \lambda_{x62} \xi_2 + \delta_6 \end{aligned}$$



ξ (xi) = latent exogenous (i.e., independent) variable

y_i = indicators of endogenous variables

SEM

The second set describes the relationship between the indicators of the endogenous variables (\mathbf{y}), their associated measurement error ($\boldsymbol{\varepsilon}$), and the latent endogenous variables ($\boldsymbol{\eta}$):

$$y_1 = \lambda_{y11} \eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{y21} \eta_1 + \varepsilon_2$$

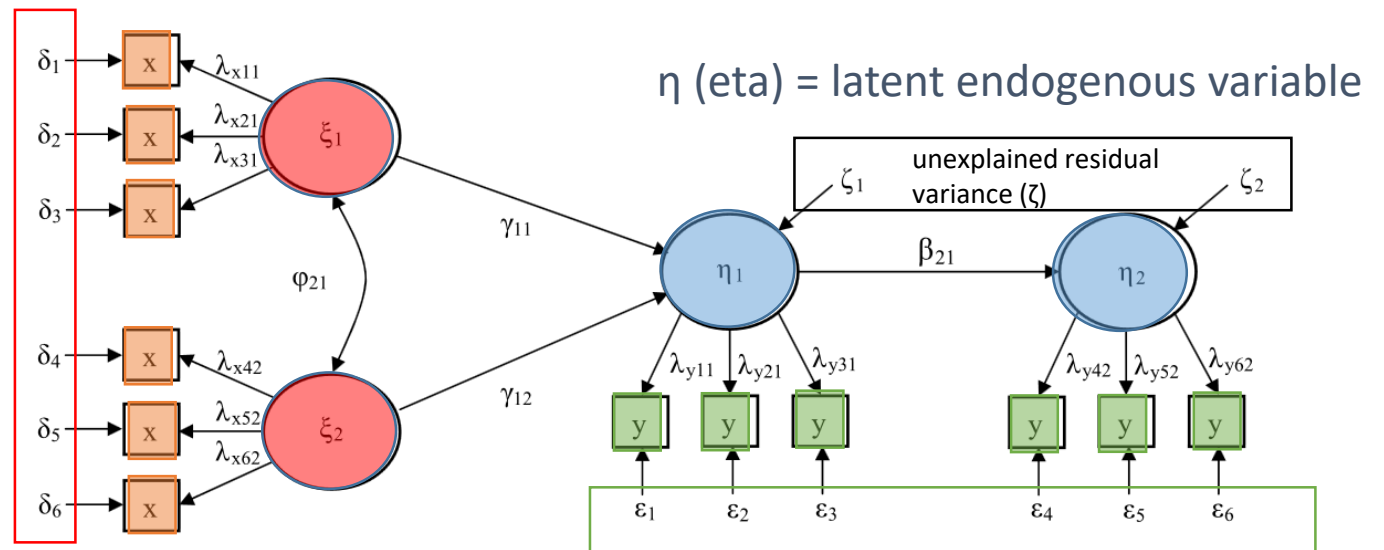
$$y_3 = \lambda_{y31} \eta_1 + \varepsilon_3$$

$$y_4 = \lambda_{y42} \eta_2 + \varepsilon_4$$

$$y_5 = \lambda_{y52} \eta_2 + \varepsilon_5$$

$$y_6 = \lambda_{y62} \eta_2 + \varepsilon_6$$

x_i = indicators of exogenous variables



ξ (xi) = latent exogenous (i.e., independent) variable

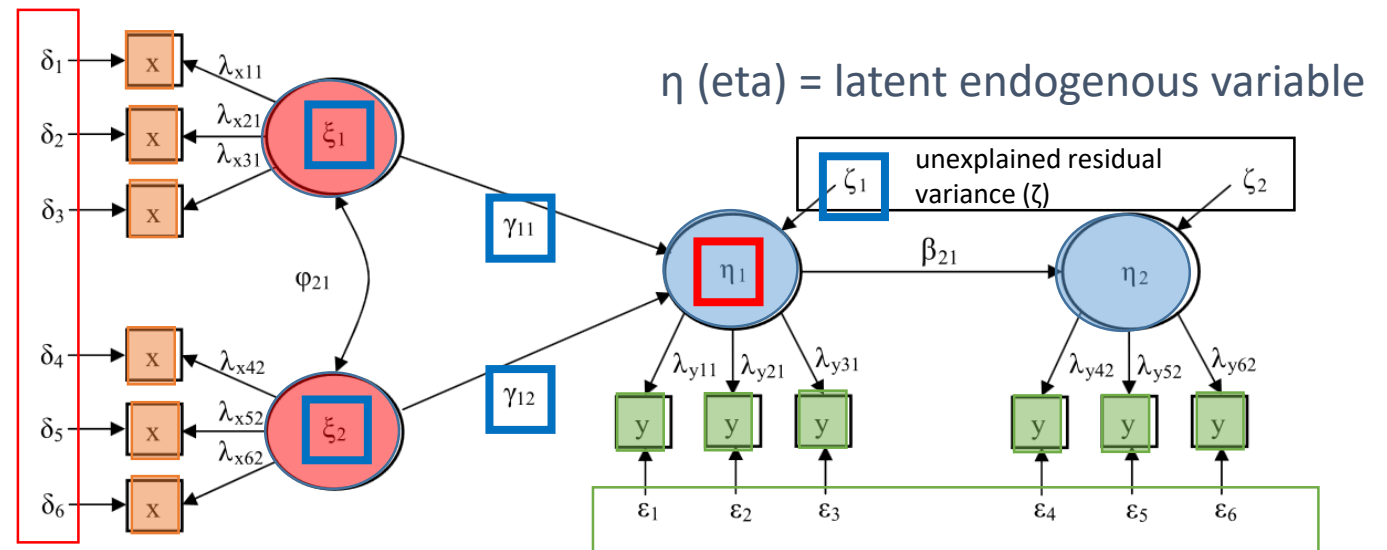
y_i = indicators of endogenous variables

SEM

- The last set deals with the relationship between the latent endogenous (η) and exogenous (ξ) variables:

x_i = indicators of exogenous variables

$$\eta_1 = \gamma_{11} \xi_1 + \gamma_{12} \xi_2 + \zeta_1$$



ξ (xi) = latent exogenous (i.e., independent) variable

y_i = indicators of endogenous variables

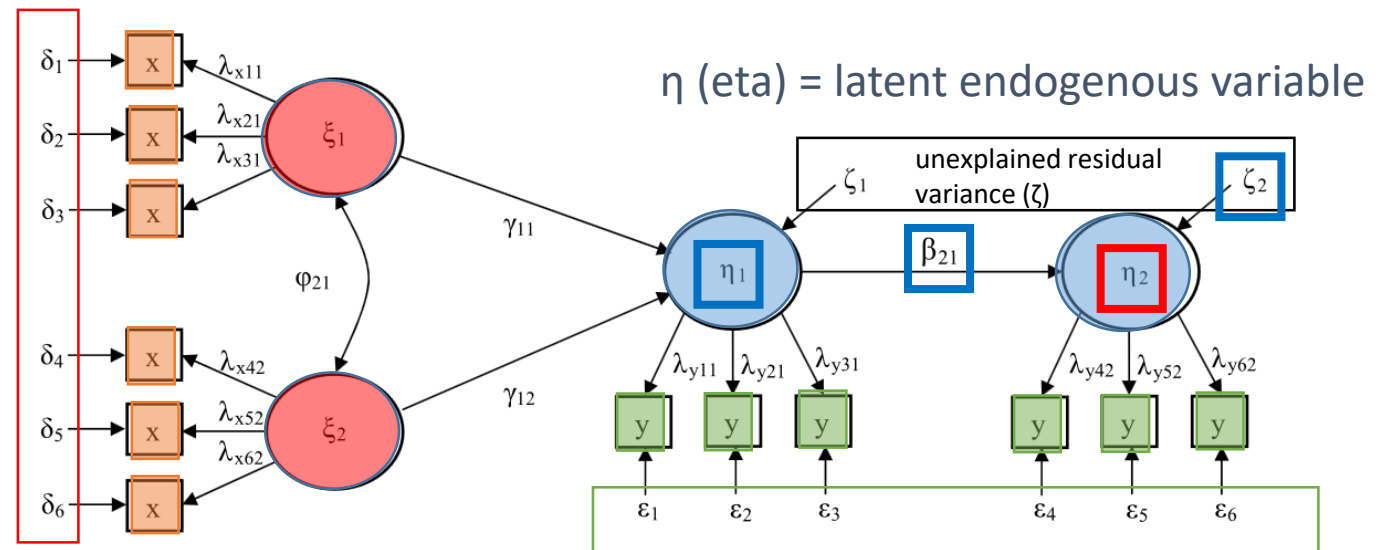
SEM

- The last set deals with the relationship between the latent endogenous (η) and exogenous (ξ) variables:

$$\eta_1 = \gamma_{11} \xi_1 + \gamma_{12} \xi_2 + \zeta_1$$

$$\eta_2 = \beta_{21} \eta_1 + \zeta_2$$

x_i = indicators of exogenous variables



ξ (xi) = latent exogenous (i.e., independent) variable

y_i = indicators of endogenous variables

SEM - disturbance terms

- The random disturbance terms ζ do not reflect measurement error, but are known as “errors in equations” and “reflect random disturbances (i.e. they indicate that the endogenous variables are not perfectly explained by the independent variables).”

SEM - Matrix

- Applying matrix algebra, the sets of equations can also be written in the following way

$$x_1 = \lambda_{x11} \xi_1 + \delta_1 \dots$$

$$y_1 = \lambda_{y11} \eta_1 + \varepsilon_1 \dots$$

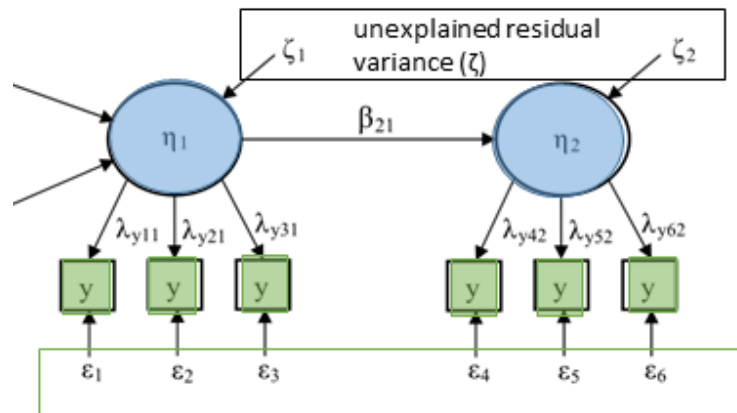
$$\mathbf{x} = \boldsymbol{\lambda}_x \boldsymbol{\xi} + \boldsymbol{\delta}$$

$$\mathbf{y} = \boldsymbol{\lambda}_y \boldsymbol{\eta} + \boldsymbol{\varepsilon}$$

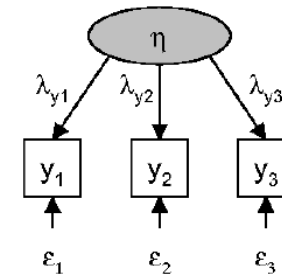


Indicators

η (eta) = latent endogenous variable



Reflective indicators



- Depend on the latent variable
- Should be highly positively correlated
- Example: Timeliness
 - Accommodation of last minute requests
 - Punctuality in meeting deadlines
 - Speed of returning phone calls

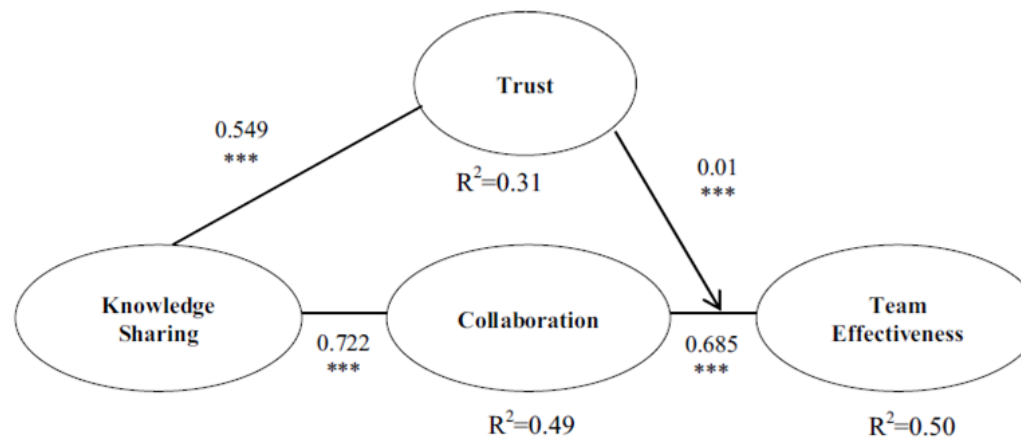
Partial Least Squares (PLS)

- The basic idea of PLS is quite straightforward:
- First, the weight relations (loadings), which link the indicators to their respective unobservable variables, are estimated.
- Second, case values for each unobservable variable are calculated, based on a weighted average of its indicators, using **the weight relations** as an input.
- Finally, these case values are used in a set of regression equations to determine the parameters for the structural relations



Knowledge sharing

- Knowledge Sharing has no R^2 value as it is an exogenous (independent) variable. The model explains 31% of the variance in Trust, 49% of collaboration variance and 50% of the variance in team effectiveness. The path coefficients between knowledge sharing and trust, knowledge sharing and collaboration, and collaboration and team effectiveness are significant at $p < 0.002$.



Trust

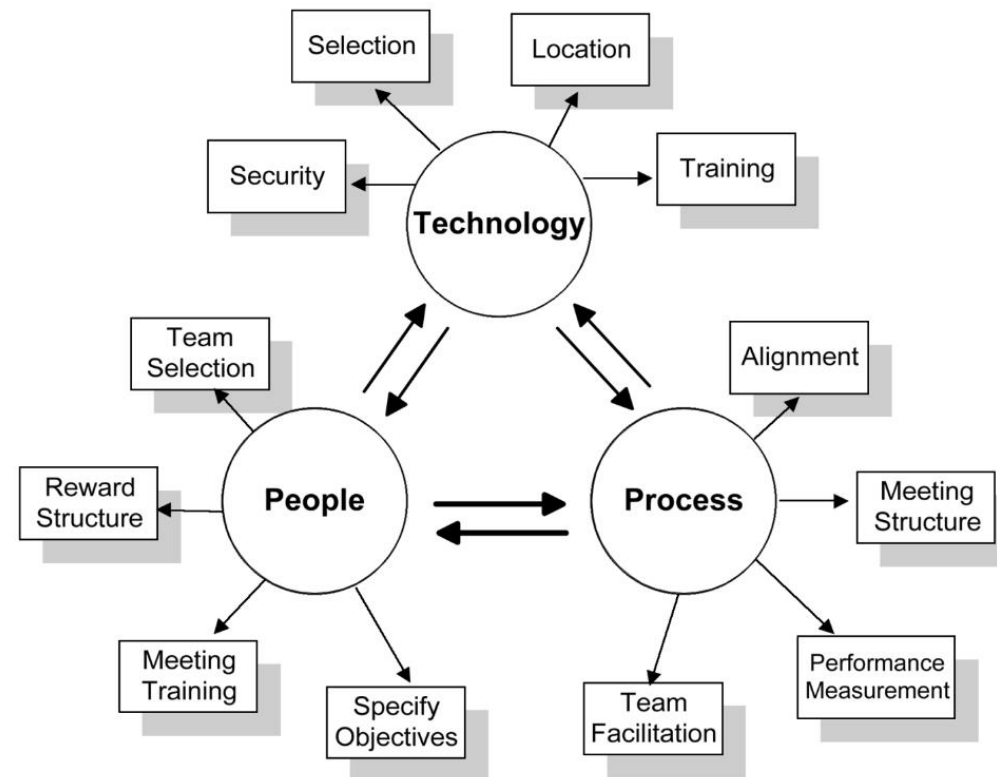
- Exploratory interview analysis performed by Gibson and Manuel suggests that teams with greater cultural differences (Team Europe Connect) were characterized by a greater proportion of negative expressions of trust than teams with fewer cultural differences (Aerospace Alliance and Auto Unification).

	<i>Mean Number of Individual Negative Expressions of Trust</i>	<i>Standard Deviation</i>
Europe Connect	10.88	5.38
Aerospace Alliance	2.88	2.52
Auto Unification	2.00	1.67
Total	4.39	4.69

<i>(I) Team</i>	<i>(J) Team</i>	<i>Mean Difference (I – J)</i>	<i>Standard Error</i>	<i>Significance</i>
Europe Connect	Aerospace Alliance	*7.9926	1.361	.011
	Auto Unification	*8.8750	1.475	.006
Aerospace Alliance	Europe Connect	*-7.9926	1.361	.011
	Auto Unification	.8824	1.229	.620
Auto Unification	Europe Connect	*-8.8750	1.475	.006
	Aerospace Alliance	-.8824	1.229	.620

Model of effective virtual team

A 12 elements model for effective virtual team working



Communication tool and style

- Virtual communication is often less frequent and less rich.
- Teams in which members have low language commonality could use a lean medium such as e-mail to increase the effectiveness of their communication.
- Teams with a high degree of cultural difference (see Hofstede) could select a rich medium when sharing complex messages.



Activity

The professional body for HR and people development provided a very practical overview:

<https://www.cipd.co.uk/knowledge/fundamentals/relations/flexible-working/remote-working-top-tips>



Questions?

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