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## System thinking peter senge ppt

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SYSTEMS THINKING: Lessons from the fifth Fieldbook discipline by Senge, Kleiner, Roberts, Ross and Smith's Upcoming SlideShare Download in... 5 x 1 How is this presentation? Why not share it! ThinkingLessons from the fifth discipline Fieldbook by Senge, Kleiner, Roberts, Ross and Smith Presentation by Joanna Beltowska @jbeltowska Amy Ray @elucidateamy©2 011 JOAN N A B ELTO WSK AN D AMY RAE. Oh hai again!©2 011 joan n a b ELTO WSK an d AMY RAE. 2 All of these things are systems.©2 011 JOAN N a B ELTO WSK AN D AMY RAE. 3 Are you looking at the system or a bunch of things? Can you identify individual parts? 1 Do parts affect each other? 2 Do the pieces produce together an effect that is 3 different from the effect of each part in itself? Is the effect maintained in the various four circumstances? x©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 4 Ping Pong is a system. IT HAS IDENTIFIABLE INDIVIDUAL PARTS. PART 2 PART 1 PART 3 PART 4©2 011 JOAN N A B ELTO WSK A D AMY RAE. 5 Ping Pong is a system. THE PARTS AFFECT EACH OTHER. LAWS OF PHYSICS RULES THE RULES OF THE GAME LAWS OF PHYSICS©2 011 JOAN N A B ELTO WSK A D AMY REY. 6 Ping Pong is a system. TOGETHER, THESE PARTS CREATE A UNIQUE EFFECT. LAWS OF PHYSICS RULES THE RULES OF THE GAME LAWS OF PHYSICS©2 011 JOAN N A B ELTO WSK A D AMY REY. X 1, X 2, X 3... 8 Search and analysis of systems is a difficult job. The following pages will introduce a system thinking, a set of tools and techniques that will help you along the way.©2 011 JOAN N A B ELTO WSK A D AMY RAE. 9 WARNING: Systems always surprise us. Don't worry! So for three main reasons why.©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 10 rs inke h rt ea o n - linea rWe are lin in n wo r l d.©2 011 joan n a b elto wsk an d'ath r. 11 In nonlinear relationships, the cause does not produce a pro-report effect. 66 is the optimal amount of fertilizer to be applied, and if too much is applied, yields may even go down. Harvest Fertiliser application©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 12 Reality consists of circles, but we see straight lines. That's the beginning ограничения как системных мыслителей. Питеп Сенге©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 13 The The Double Dunk Formal Education rewards the language of form of perception. linear thinking. Studies with young children of Western languages are biased indicates that we have to linear worldview hidden skills as systems because of their thinkers who are the subject of a verb undeveloped, even object structure. It is repressed, the formal structure teaches our education. brains to bind thoughts in the same way.©2 011 joan n a b ELTO WSK AN D AMY RAE. 14 In the real world, there are no boundaries. There are only thought, perceptions and social agreement.©2 011 JOAN N a B ELTO WSK AN D AMY RAE. 15 BOUNDED RATIONALITYIn decision-making, the rationality of individuals is limited by the information they have. Fishermen are unaware of the total number of fish in the ocean or how many fish others collect. This is a typical example of a dilemma called the Commons Tragedy - a situation in which a group of individuals acts rationally in their own interests and depletes a common limited resource.©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. 16 E xp li ci t kn ow le dg eMENTAL MODELIndividuals are also inhibited by their mental models - the images, assumptions and stories we carry in our thoughts about ourselves, other people, institutions and every aspect of the world. Taci t know protrusion©2 011 joan n a b ELTO WSK an d AMY RAE. 17 Systems deceive us into presenting us as a single event. The stock market collapsed in 1929, making headlines. This single event was overrated, and other, more importantly, events affecting the Great Depression were less visible as the 200,000 factory workers replaced by machines and the cost of farmland falling by 40%.©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. 18 Events accumulate in dynamic behavior patterns. 66ign begins Wheat price for a bushel in dollars 32.5 21.5 10.5 0 1900 1910 1920 1930©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 19 Long-term behavior provides the key to the structure of the base system. System structures are created by choices that people make consciously or unconsciously over time. In system thinking, structure is a sample of the system's key components. This may include hierarchy and process, but it also includes relationships and representations, product quality, decision-making methods, etc. 66wee the winter of 1929 was the so-called long winter wave. The Long Wave Theory, a subset of systemic thinking, says the economic crisis comes and goes cyclically.©2 011 JOAN N A B ELTO WSK A D AMY RAE. 20 Researchers from the Massachusetts Institute of Technology have come up with ways to understand and categorize different types of systems.©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. 21 With practice, these tools can help you unpack complex problems in an instant. Think of these tools as your diagnostic 011 JOAN N A B ELTO WSK AN D AMY RAE. 22 22 and LoopsT H E F O UND A T I O O F SYST E M M D E L I NG A LINK:Links are arrows representing the impact between elements of the system. NUMBER OF TIME SPENT LOLCATS ON THE SITELoops are combinations of links that show the cause of Eexecency; In the cycle, each element is both an effect. LOOP:Example: The more photos of lolcat onicanhazcheeseburger.com, the more time people spend commenting on lolcat photos and being inspired to create more. (Because we all know lolcats are awesomelyhilarious!) No. TIME SPENT LOLCATS ON THE SITE©2 011 JOAN N A B ELTO WSK A A D AMY RAE. 23 Balancing and strengthening loopsT W O T YPE S O F L O O P S H A T CCUR F RE and UE NT L YBalancing loops occur in systems that are self-regulating. Us ARMSThe system has an inherent purpose, and when this goal is not a meter, intense pressure is applied to achieve it. (R) NEED TO BUILD THREAT TO US ARMS SOVIET UNIONExample: The purpose of your fridge is to keep food at cold 35 degrees. When half-eaten pizza enters, the refrigerator raises the temperature to cool the warm pizza, causing threat NEED TO BUILDthe refrigerator returns to equilibrium. In the U.S., SOVIET ARMSReinforcing loops occur in systems that steadily grow ARMSand/or collapse over time. Example: The Nuclear Arms Race between the United States and nuclear STOCKPILES 1945 - 2005Soviet Union during the Cold War is a typical example of an exponential cycle of growth. The U.S. created the first atomic bomb in 45,000 Soviet U.S. 40,0001945. The Soviet Union followed in 1949. By the 1950s, both 35,000 sides had enough nuclear power to destroy each other. The 30,000 25,000 system then declined when both stocks declined in the 2000190s. 15000 10000 5000Source:Natural Resources Defense Council (1946-2002 data), 0Bulletin atomic scientists (data 2003-200 6) 1945 1955 1965 1975 1985 1995 2005©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 24 Balancing and strengthening the loop: TemplatesA D PT E D F RO M T H E F I F T H I SCI PL I NE B Y PE T E R M . S E NGE . U.S. E H E E M PL A T E S A S S S T A T A T A I NG PL A CE F O R S YS E M A NA L YS I S . REINFORCING LOOP TEMPLATE BALANCING LOOP TEMPLATE Additional Intermediate Element (may be a goal or goal to be a consequence of performance) Actual performance (desired performance, either (which you measure or are known or unknown to you)Actual performance compliance; often the problem (what you measure or symptom) is to observe that you can seegrowing or decrease) Growing action (R) (what you do, or someone else doing, to create growth or decrease) (B) Additional gap (the discrepancy between the intermediate desired and the actual element (may be performance, either additional intermediate performance driver element) you as a deficit, obviously as (may be a performance driver and/or consequence) consequence) (may be a fast qx or driver of your performance) ©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. 25 The Cause Loop Chart E L P I NG YO U E L A M O RE RO B UST O R YCausal Cycle Charts combine several loops and reveal - WEAK ORmore details about the system. Plus points out that THE UNCERTAIN PERCEIVED ECONOMICelements are changing in the same direction, while minus - SOLVENCY OF BANK CONDITIONIndicates that the elements are changing in opposite directions. - Example: Banking panic during the Great Depression was SOLVENCY (i) STRAD BANK BANK FAILUREcaused public fear of bank failure. This forced people to use their personal savings, reducing the solvency of banks, which in turn led to the further withdrawal of funds from private sources in the cycle TREND TO BANK RESERVES WITHDRAWspiraling, strengthening, cycle. ON HAND PERSONAL SAVINGS - A random cycle diagram describing bank panic during the Great Depression (adapted from John Sturman's Beyond Training Wheels).©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 26 System ArchetypesA PE D D I T T B B L O F E H M ST M M N SYST E M E H A VI O RSIf We think of each system as history, system archetypes are classic stories that we continue to see over and over again. By measuring our systems against these classics, we challenge CURRENT STAFFING Fix symptom OF PROFITS CUTSscan to quickly identify dominant behavioral patterns. For example, Fixes That Backfire: The company struggles with profitability (symptom problem) and decides to let people go to cut costs (fix). Profitability is initially improved, but the loss of experienced employees, as well as the reduction of moral impact on productivity negatively (consequences of PRODUCTIVITYuninded). The unintended consequences of PROBLEM SYMPTOM Fix apply to the Initial Tolerance Threshold©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 27 Archetypes: Comparison ChartA D PT E D F RO M H E F F F H I SCI PL I NE B Y PE T E R M . S E NGEBALANCING LOOP REINFORCING LOOP FIXES THAT BACKFIRETheres movement to the target (without an important variable accelerates up (or down), the symptom of the problem alternately improves (thedelay), or fluctuations hovering around one with exponential growth or collapse. (the problem is going up, worse than before). LIMITS TO GROWTH SHIFTING THE BURDEN TRAGEDY OF THE COMMONSThere growth (sometimes a sharp increase), dependence on short-term fixes becomes stronger, overall activity grows, but benefits from individual levels or falling into decline. while efforts to fundamentally correct real activity are falling, problem is getting weaker. The symptom of the problem alternately improves and worsens. ACCIDENTAL ADVERSARIESProformability of each party either decreases or remains low, while the enemy or ©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. 28 Promotions and FlowsA D PT E D F RO M T H I NK I NG I N SYST E M S B Y D O L L A M M M A D O O W SStock and Flow Charts are another way to analyze systems. Stocks are tangible and measurable, and they ≠ change over time due to the actions of the flows. Stocks operate asbuffers, delays or shock absorbers in systems. Example: Imagine that you have decided to take a bath. You start Stockto fill the bath with hot water and go read while you wait for the bath to fill. When you return, the water isa too hot to your liking. To get the temperature downquickly, you open the drain and turn cold water tapon. Your bathtub is now a simple system with one reserve (bath water), one tributary (cold water) and oneoutflow (water that goes through the sewer). WATER IN BATH TUB COLD WATER DRAINED WATER IN\*OW Stock OUT\*OW©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 29 System Analysis Guidelines H E SYST E M S T O O L K I N A A CT I O NAll models are real-world simplifications. It's up to you to decide how many details to illustrate. There are no correct answers. Displaying the system will allow you to work out a set of potential actions that you can take. As you become more proficient systems thinker, you will begin to recognize the consequences of different interventions. Cause and effect will not be closely related in time and space. Don't look for levers near the symptoms of yourproblem. Good results in a complex system depend on attracting as many perspectives as much as possible. Think about who else you can come up with to make your system model more informed. Use your intuition when you work with archetypes. Its uncritical that you choose the right archetype - as long as he ringstrue with your story, its good enough as a starting point.©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 30 A good system thinker avoids traps, looking for several left-lookings working simultaneously. THE LEVERS FOR LASTING CHANGE IN MENTAL PATTERNS OF SYSTEMIC BEHAVIOR EVENTS ARE ADAPTED FROM THE FIFTH DISCIPLINE OF FIELDBOOK PETER M. SENGE©2 011 JOAN N A B ELTO WSK A D AMY RAE. 31 Good Systems Thinkers make good strategists ST O RY O F H O W ST RA T E D E E E D 1: 2 5 O D D SOn October 26, 1597, Korean Admiral Yi Sun-sinfamously defeated the Japanese fleet of 333 units with only Admiral I: badass13 ships at his disposal. systemic thinker. Yi strategically chose the Myeongnyang Strait as the arenafor his last stand with the Japanese based on its strongcurrents, narrowness, rough tides and surrounding shadowyhillides. Reading the environment as a system, Admiral Jesus said it in his favor. No other naval battle involving fleets of this size hasresulted in victory for such proportionately small forces, and makes it one of the greatest military achievements in world history.©2 011 JOAN N A A B ELTO WSK A A D AMY RAY. 32 Cancer (?) The problems facing society are growing. Measles (1963) Smallpox (1796)©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 33 In order to meet these challenges, we need to explore new ways of thinking. System thinking is the cornerstone of how adaptive organizations think about their world.©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 34 Designing The Workshoppt T I NG SYST EMS T H I NK I NG I NT O PRA CT I CETackling is a huge problem? System analysis will help identify multiple sides of the problem and identify areas of non-potation. Workshops or brainstorming are excellent forums for this kind of analysis. Below is a (very) general overview of a good workshop: Explore up: Learn your links, loops and archetypes. Forpractice, sketch out systemic diagrams of popular problems such as global warming or Poverty.Event Prep: Invite stakeholders from all levels of reorganization; Unique perspectives will make the analysis more reliable. Choose a room with a white board and bring your markers! Simplification: Overall, spend 1/4 of your time implementing the concept and creating a safe space for open discussion. Spend 1/2 of your time analyzing the problem on White Dart suggests you use Five Whys to help the group discover a deeper board with the Toolkit system, and spend the remaining 1/4 of the interactions between elements.looking for possible activities in your chart.©2 011 JOAN N A B EL WSK A AN D AMY RAE. 35 It's like an old expression: You are what you eat. If you start thinking differently, you see things differently. And all your actions are starting to change. - Pat Walls, FedEx Ready Are You Ready to Go On a Loop-Based Diet?©2 011 JOAN N A B ELTO WSK AN D AMY RAE. 36 Special thanks to our mentors and friends at Systems ThinkingLessons from The Fifth Discipline Fieldbook by Senge, Kleiker, Roberts, Ross and Smith Presentation Joanna Beltowska @jbeltowska Amy Rae @elucidateamy©2 011 JOAN N A B ELTO WSK A AN D AMY RAE. Ray.