Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Oakland, California

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Introduction

Healthy Kids Oakland Partnership is one of 49 community partnerships participating in the national *Healthy Kids, Healthy Communities* program of the Robert Wood Johnson Foundation (www.healthykidshealthycommunities.org). The purpose of this *Healthy Kids Oakland Partnership* project was to introduce systems thinking at the community level by identifying the essential parts of the Oakland, California system and how the system influences policy and environmental changes to promote healthy eating and active living as well as to prevent childhood obesity. To accomplish this goal, community partners and residents participated in a group model building session and discussions. The group model building exercises were designed by staff from Transtria LLC and the Social System Design Lab at Washington University in St. Louis, Missouri as part of the *Evaluation of Healthy Kids, Healthy Communities* funded by the Robert Wood Johnson Foundation. These exercises actively involved a wide range of participants in modeling complex systems and provided a way for different representatives (e.g., academic institutions, non-profit organizations, community-based organizations, and advocates) to better understand the systems (i.e., dynamics and structures) in the community (see the *Healthy Kids, Healthy Communities Group Model Building Facilitation Handbook*, www.transtria.com/hkhc). Overall, the evaluation was designed to assess policy, system, and environmental changes as a result of the community partnerships' efforts to increase healthy eating and active living in order to reduce childhood obesity.

Oakland, California: Background and Local Participation

The Healthy Kids Oakland partnership is focused on 25 school communities located in Oakland's five most impoverished neighborhood districts, West Oakland, San Antonio, Fruitvale, Central East Oakland, and Elmhurst. Approximately 10,000 children, youth and families are involved with the 25 school communities. The population is more than 90% Latino, African American and Southeast Asian. The demographics in the neighborhoods surrounding the schools had evolved from African American to Latino.

Each campus sits in a high-poverty neighborhood without any full-service grocery store; liquor and convenience stores serve as many residents' primary source of food. The schools also lack adequate recreational space, and the space they have is closed to the public on evenings and weekends due to crime.

Oakland Unified School District (OUSD) has 100 schools in the district comprised of elementary, middle, and high schools. All of OUSD schools are under-enrolled, but over the last 10 years, there has been a 30% decrease in student population, with the highest amount leaving after fifth grade. The rate of decline is not due to student drop-outs, but is contingent upon academic grades and relocation. Because only 60 to 70 percent of OUSD middle school students perform at grade level or above, elementary students who earn high grades transferred out of the district. Students were documented as moving to Alameda and Berkeley and transferring to other city schools. A number of schools closed, forcing the district to prepare extensions (i.e. Kindergarten through eighth grade). Approximately 96% of students are eligible for free or reduced priced lunch in the entire OUSD. As the student population remains, the need for improvements in Oakland's schools will continue to grow. People living in the communities are not moving a lot. There is a high concentration of independent charter schools with about 18% of the student population district-wide.

The East Bay Asian Youth Center (EBAYC) is the lead agency for the Healthy Kids Oakland partnership. East Bay Asian Youth Center is a non-profit organization primarily worked in San Antonio neighborhood and the Chinatown neighborhoods. These areas are under-resourced neighborhoods, where Asian families represent a plurality, a vibrant family-supportive community. The lead agency has been established in the community for 37 years and the current executive director, also serves as the project director for the HKHC grant, has been leading the EBAYC for over 32 years.

Healthy Kids Oakland Partnership's Priorities and Strategies

The partnership was involved with healthy eating active living work historically through the Active Living by Design grant and work with the California Endowment. The work continued over the past four years through HKHC and provided some opportunities to think through sustainability of the initiatives of focus including the Oakland Fresh and Oakland Schoolyard Initiatives.

There were two distinct partnerships that are very project based for the Healthy Kids Oakland work. One partnership was around the development of the school produce market network (Oakland Fresh) and the capacity building of the district to assume the full operation and sustainability of school produce markets around the city.

The second was around Oakland Schoolyard Initiative, an effort to improve existing schoolyards to support active living. Both efforts were focused within the OUSD. The partnerships were initiated by EBAYC staff.

The partnership and capacity building strategies of *Healthy Kids Oakland Partnership* included:

- **School Involvement:** The school district is heavily involved in both the from the superintendent and facilities management staff for the school yards initiatives to the teachers and food service staff for the school produce markets.
- **Parent Involvement:** The parents in the communities are actively engaged in the school produce markets from serving as market managers to purchasing and supporting the market sales.
- **Youth Involvement:** The youth are involved with the school yards initiative to design the school yard space and create murals and art for the spaces.

The healthy eating and active living strategies of *Healthy Kids Oakland Partnership* included:

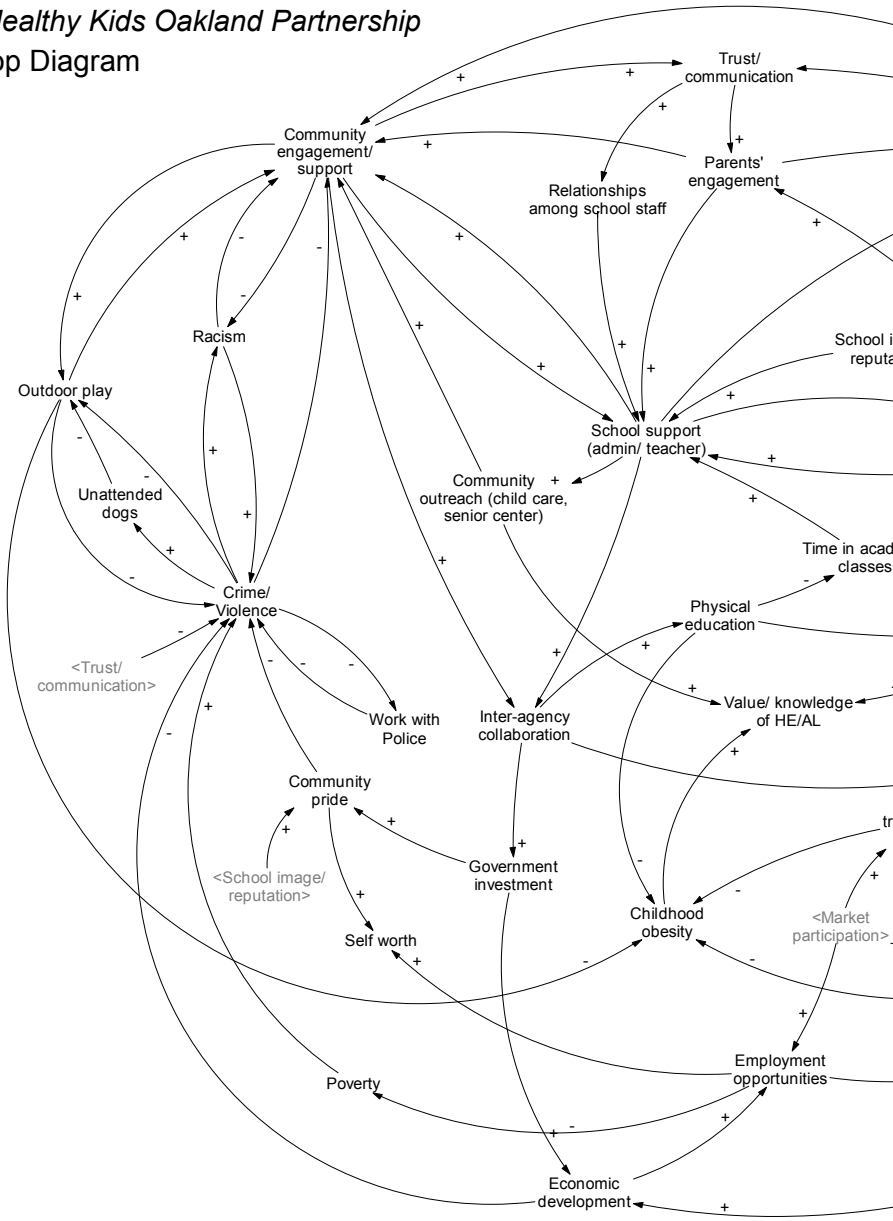
- **Parks and Play Spaces (School Yard Initiatives):** The School Yard Imitative established Memorandum of Understanding with school district identifying the schoolyards initiative as an important opportunity to improve the school environment. Schools were identified for improvements and three large schoolyard improvement projects were completed (Lowell Middle School, Sobrante Park Elementary School, Garfield Elementary School) , while two school schoolyards were redeveloped (Roosevelt Middle School, Sankofa K-8 Academy). To continue the momentum around improving schoolyards, the Healthy Kids Oakland partnership developed and received approval for a new Facilities Master Plan, and passed partial financing for the new Facilities Master Plan through a $450 Million General Obligation Bond Measure with approximately 83% of the votes. Approximately 10 schools were identified and were in the design phase for major renovation work utilizing the new Facilities Master Plan, EBAYC secured a Use Agreement with Roosevelt Middle School to organize and supervise recreational sports activities at the newly constructed outdoor field and gymnasium Monday through Friday, from 6:00pm to 8:00pm, and on Saturdays, from 9:00am to 12:00pm.
- **Farmers' Markets (School Produce Markets):** The major policy, system, and environmental changes for the Oakland Fresh Produce Markets included: established Memorandum of Understanding between EBAYC and OUSD, transitioned Oakland's Fresh Produce Markets program into the school district's Nutrition Services Department, established 22 operational markets at schools (two of which were originally operated by EBAYC, established the Central Distribution System with ensuring the warehouse distribution center was up to code consisted of repairing refrigerators and certifying market managers in food safety; distribution trucks were in place with the school district and paid for by the school district; and permits were required to operate Oakland Fresh and vendors needed to secure liability insurance, established two new school district positions and recruited, hired, and trained employees for District's Oakland Fresh Produce Markets program, enabled EBT use at 22 markets to ensure lower-income families living in the area had access to buy fresh produce, ensured market managers were food safety certified bypassing a food safety certification class.

For more information on the partnership, please refer to the Oakland case report (http://www.transtria.com/hkhc_case_reports.php).

Systems Thinking in Communities: Oakland, California

"Systems thinking" represents a range of methods, tools, and approaches for observing the behaviors of a system (e.g., family, community, organization) and how these behaviors change over time; changes may occur in the past, present, or future. Figure 1 illustrates a system of policies, environments, local collaborations, and social determinants in Oakland, California that influence healthy eating, active living, and, ultimately, childhood obesity. This system and the dynamics within the system are complicated with many different elements interacting.

Figure 1: *Healthy Kids Oakland Partnership* Causal Loop Diagram



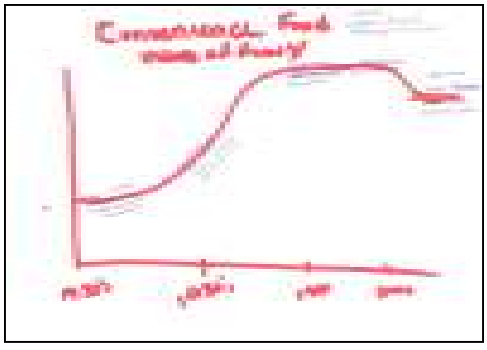
Models, such as Figure 1, provide a way to visualize all the elements of the system and their interactions, with a focus on causal relationships as opposed to associations. Through the model, specific types of causal relationships, or feedback loops, underlying the behavior of the dynamic system, can be identified to provide insights into what is working or not working in the system to support the intended outcomes (in this case, increases in healthy eating and active living, and decreases in childhood overweight and obesity). In system dynamics, the goal is to identify and understand the system feedback loops, or the cause-effect relationships that form a circuit where the effects "feed back" to influence the causes.

Group Model Building

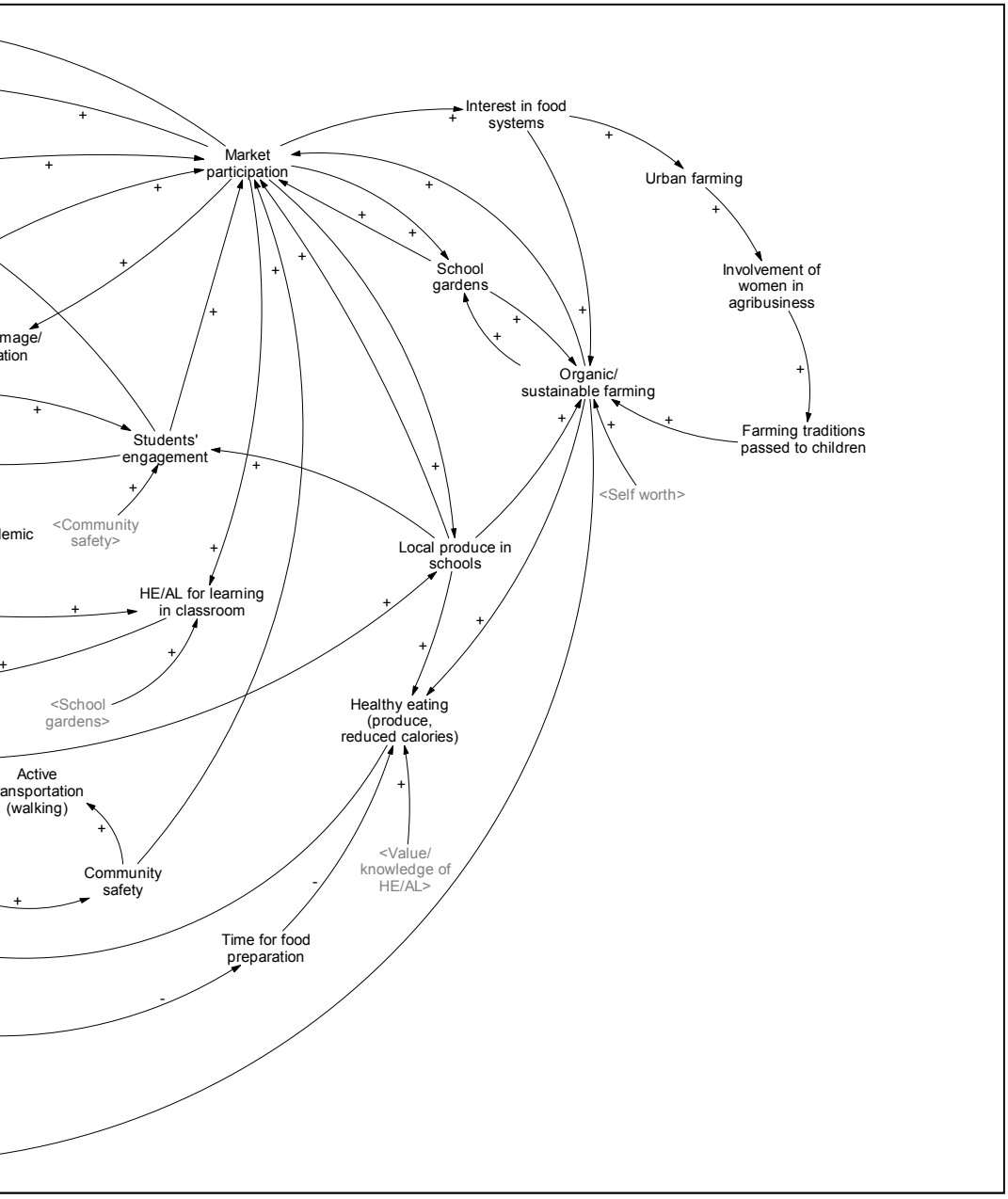
Members of the *Healthy Kids Oakland Partnership* participated in a group model building session in January 2012 and generated this system. also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included representatives from academic institutions, non-profit organizations, community-based organizations, and advocates. The group model building session had two primary activities: 1) a Behavior Over Time Graph exercise; and 2) a Causal Loop Diagram (or structural elicitation) exercise.

<u>Behavior Over Time Graphs</u>

To identify the range of things that affect or are affected by policy, system, and environmental changes in Oakland related to healthy eating, active living, and childhood obesity, participants designed graphs to name the influences and to illustrate how the influences have changed over time (past, present, and future). In this illustration for convenience food, the number of families eating convenience food has increased



From 1920 to 2012 and the participant hopes that it will decrease and change into the future. Each graph is a tool to increase the use of common, specific language to describe *what* is changing in the community as well as *when*, *where*, and *how* it is changing. The graphs capture participants' perceptions of the influence, or variable, and through the graph, the participant tells their story. These perceptions are based on actual data or evidence, or they are part of the participants' lived experience.



Causal Loop Diagram

To examine the relationships among the variables from the behavior over time graphs, participants worked together and with facilitators to develop a causal loop diagram. In Figure 1, the words represent variables of quantities that can increase and decrease over time (i.e., the behavior over time graphs). These variables are influenced by other variables as indicated by the lines with arrows. The lines with arrows represent causal relationships - this is what is known about the system and how it behaves.

For instance, there are many feedback loops influencing or influenced by community engagement/support in this causal loop diagram. One feedback loop is: community engagement/ support → racism → crime/ violence → community engagement/support. A second feedback loop is: community engagement/support → trust and communication → parents engagement → community engagement/support.

What is important to notice in these examples is that there are two different feedback loops interacting simultaneously to influence or to be influenced by community engagement/support. Some variables may increase community engagement/support while other variables limit community engagement/support. Determining the feedback loop or loops that dominate the system's behavior at any given time is a more challenging problem to figure out, and ultimately, requires the use of computer simulations.

Based on this preliminary work by the *Healthy Kids Oakland Partnership*, this "storybook" ties together the behavior over time graphs, the participants' stories and dialogue, and feedback loops from the causal loop diagram to understand the behavior of the system affecting health in Oakland, California and to stimulate greater conversation related to Oakland's theory of change, including places to intervene in the system and opportunities to reinforce what is working. Each section builds on the previous sections by introducing concepts and notation from systems science.

Causal Loop Diagram for the Childhood Obesity System

The causal loop diagram (CLD) represents a holistic system and several subsystems interacting in Oakland, California In order to digest the depth and complexity of the diagram, it is helpful to examine the CLD in terms of the subsystems of influence. Because of this project's focus on healthy eating, active living, and childhood obesity, this system draws attention to a number of corresponding subsystems, including: healthy eating policies and environments (red), active living policies and environments (blue), health and health behaviors (orange), partnership and community capacity (purple), and social determinants (green).

From the group model building exercises, several variables and causal relationships illustrated in Figure 2 were identified within and across subsystems. This section describes the subsystems in the CLD.

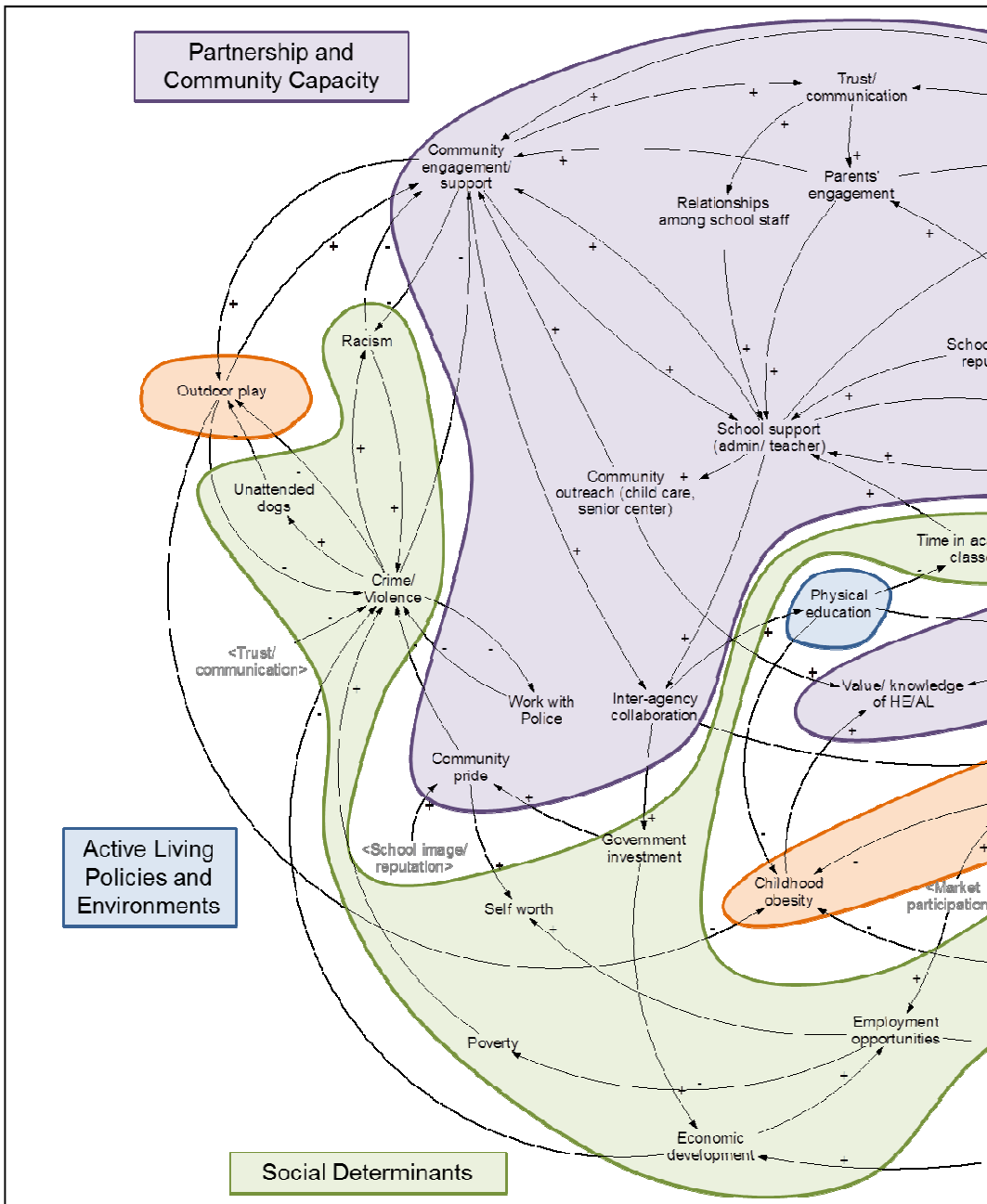


Figure 2: Subsystems in the *Healthy Kids Oakland Partnership* Causal Loop Dia

Healthy Eating Policies and Environments (Red)

The healthy eating policy and environmental subsystem includes food production (e.g., school gardens, urban farming), food distribution and procurement (e.g., involvement of women in agribusiness), and food retail (e.g., farming traditions passed to children). During the behavior over time graphs exercise, the participants generated eight graphs related to policy or environmental strategies (e.g., school gardens) or contexts (e.g., farming traditions passed to children) that affected or were affected by the work of *Healthy Kids Oakland Partnership*. The variables represent participants' conversations from the behavior over time graph and causal loop diagram exercises.

Active Living Policies and Environments (Blue)

The active living policy and environmental subsystem includes design, planning, construction, and enforcement or maintenance related to access to opportunities for active transportation and recreation. For this topic, the group model building participants developed four graphs related to policy or environmental strategies (e.g., physical education) or contexts that affected or were affected by the partnership's work.

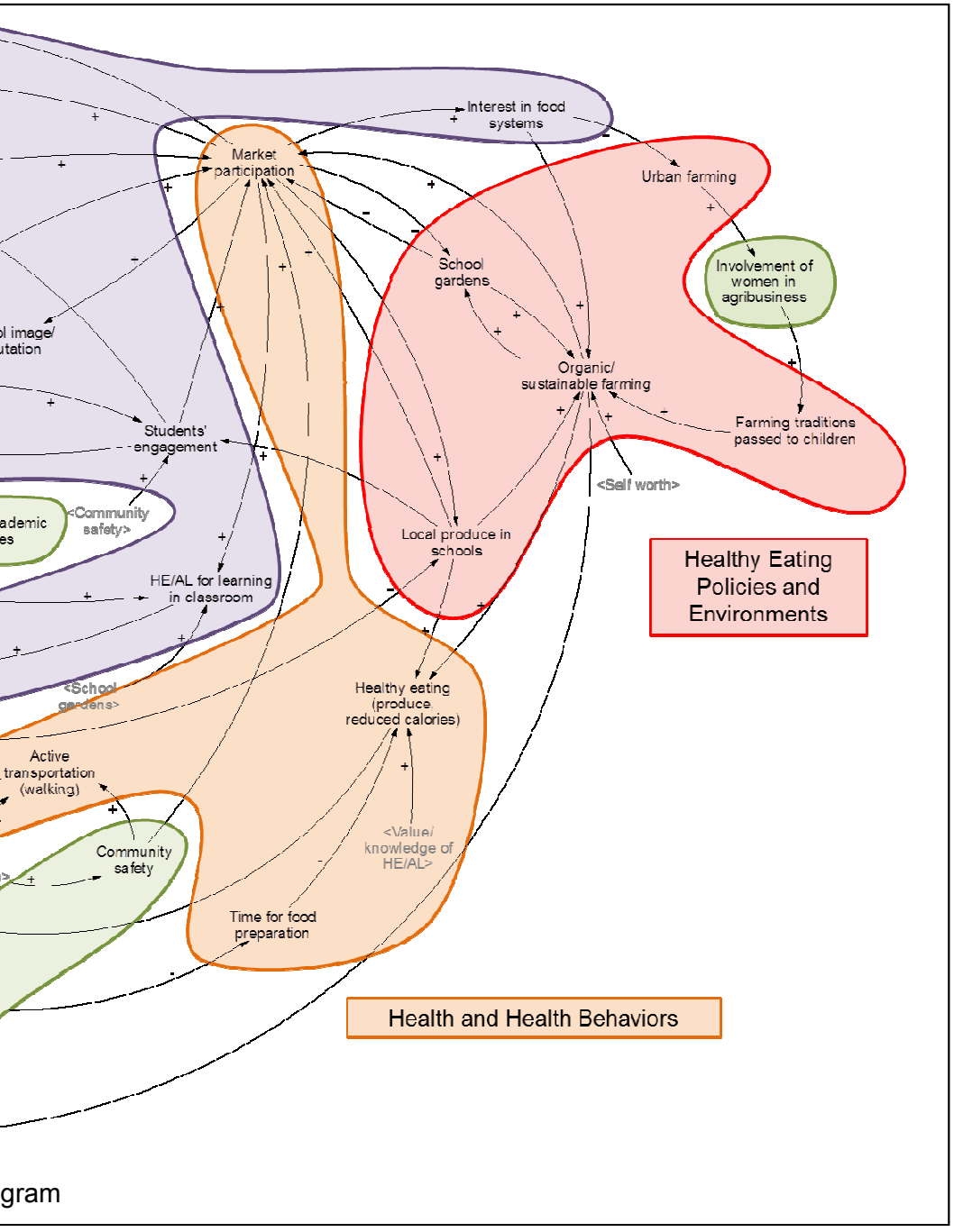
Health and Health Behaviors (Orange)

The subsystem for health and health behaviors includes health outcomes (e.g., obesity), health behaviors

(e.g., healthy eating, physical activity), and behavioral proxies or context-specific behaviors (e.g., time for food preparation, value/knowledge of healthy eating and active living).

Partnership and Community Capacity

The partnership and community capacity subsystem refers to the ways communities organized and rallied for changes to the healthy eating and active living subsystems. For instance, *Healthy Kids Oakland Partnership* has a lot of school support (administrators and teachers) for the school produce markets and the schoolyard initiatives. This subsystem also includes community factors outside the partnership that may influence or be influenced by their efforts, such as trust/communication or school image/reputation.



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Social Determinants

Finally, the social determinants subsystem denotes societal conditions (e.g., crime/violence, community safety, government investment) and psychosocial influences (e.g., self worth) in the community that impact health beyond the healthy eating and active living subsystems. In order to achieve health equity, populations and subgroups within the community must have equitable access to these resources and services.

Each one of these subsystems has many more variables, causal relationships (arrows), and feedback loops that can be explored in greater depth by the *Healthy Kids Oakland Partnership* partners or by other representatives in Oakland, California. Using this CLD as a starting place, community conversations about different theories of change within subsystems may continue to take place. For instance, these participants identified interest in understanding more about the relationships among parental involvement, school involvement, and organic/ sustainable farming.

The next sections begin to examine the feedback loops central to the work of *Healthy Kids Oakland Partnership*. In these sections, causal relationships and notations (i.e., arrows, “+” signs, “-” signs) from Figure 2 will be described to increase understanding about how systems thinking and modeling tools can work in communities to increase understanding of complex problems that are continuously changing over time, such as childhood obesity. At the end of this CLD storybook, references to other resources will be provided for those interested in more advanced systems science methods and analytic approaches.

Parent Involvement Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the *Healthy Kids Oakland Partnership* CLD (see Figures 1 and 2) are highlighted in Figures 3-7. While the CLD provides a theory of change for the childhood obesity prevention movement in Oakland, California, each feedback loop tells a story about a more specific change process.

Causal Story for Feedback Loop

Story A: In this case, the story is about the parental involvement (green highlighted loop in Figure 3). Participants described how more parent engagement influences increases participation in school produce markets. With more market participation it increases community safety. In turn, more community safety increases students engagement, which increases parents engagement.

Story B: While the preceding story reflected a positive scenario for Oakland, California, the same feedback loop also tells the opposite story. With less parent engagement there is less participation in school produce markets. With less market participation it decreases community safety. In turn, less community safety decreases students engagement, which decreases parents engagement.

Reinforcing Loop and Notation

These stories represent a reinforcing loop, and the notation in the feedback loop identifies it as a reinforcing loop (see "R1 — Parent Involvement" and green highlighted loop in Figure 3). The words represent variables of quantities that increase and decrease as illustrated in the stories above. These variables change over time and are influenced by other variables as indicated by the arrows. Each arrow represents a causal relationship, and the plus and minus signs on the arrows indicate whether or not the influence of one variable on another variable (1) increases/ adds to (plus or "+" sign), or (2) decreases/ removes from the other variable (minus or "-" sign). These signs are referred to as polarities.

In a reinforcing loop, the effect of an increase or decrease in a variable continues through the cycle and returns an increase or decrease to the same variable, respectively.

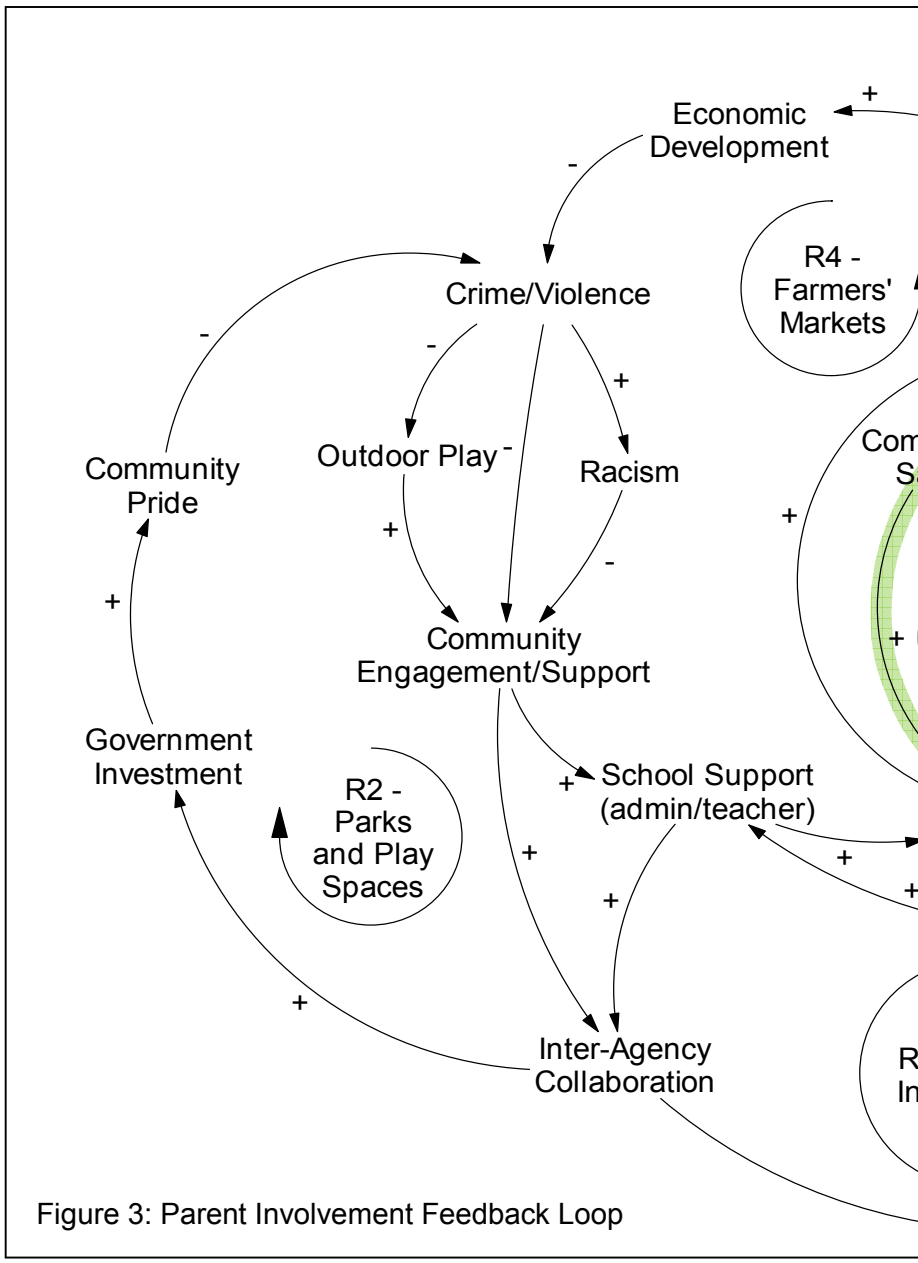
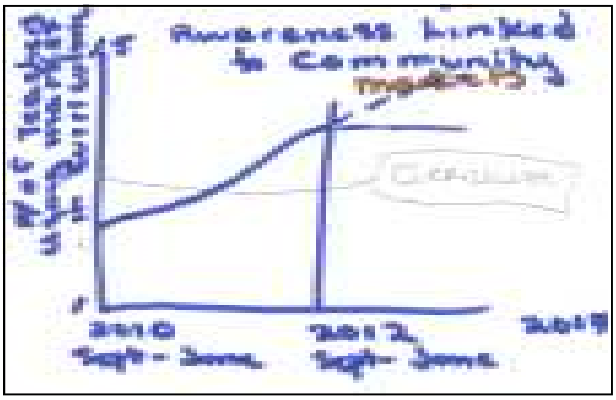


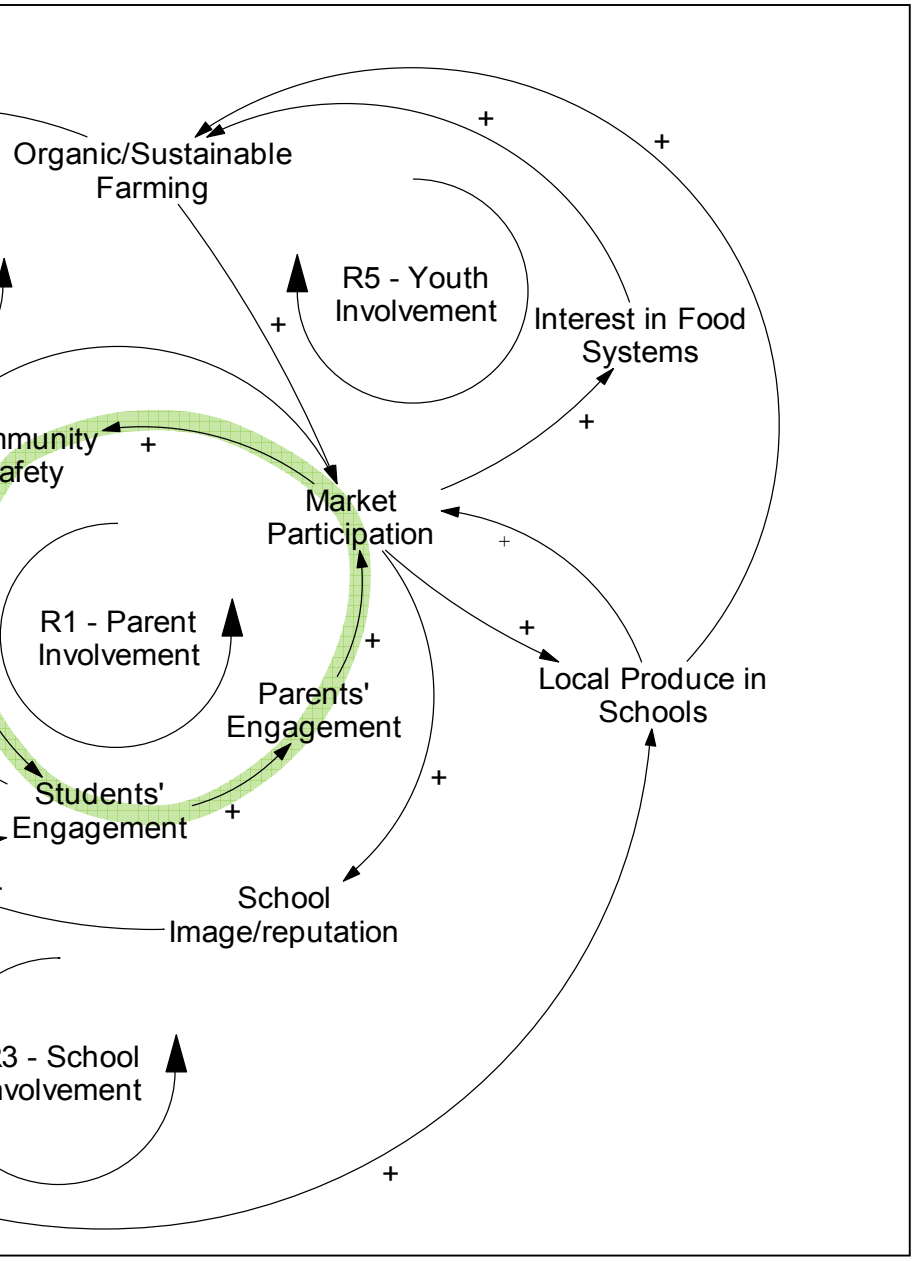
Figure 3: Parent Involvement Feedback Loop

"In working directly with students, [teachers and administrators] impact parents; information actually trickles from the students to the parents, not from us. It's not that we're not giving the parents the information, it just seems to be more effective if a student shows interest in something and it increases health at the same time. In working with the students, we are affecting the parents. And that, in turn, affects the community [participation in the markets]." (Participant)

Looking specifically at the "+" or "-" notation, a feedback loop that has zero or an even number of "-" signs, or polarities, is considered a reinforcing loop. Reinforcing loops, with zero or an even number of "-" signs, are another type of feedback loop and these are referenced in the next sections.

In isolation, this reinforcing loop represents a virtuous cycle in Story A as these assets positively support one another, or a vicious cycle in Story B as these challenges perpetuate a downward spiral. Yet, the influence of parents' engagement likely levels off at some point when there are no more parents





to get involved. To understand what specifically leads to the leveling off of parents' engagement, it may be helpful for the partners in Oakland, California to consider other variables that influence or are influenced by parents' engagement. In addition, it is important to remember that this reinforcing loop is only one part of the larger CLD (see Figures 1 and 2), and the other loops and causal relationships can have an impact on the variables in this loop.

<u>System Insights for *Healthy Kids Oakland Partnership*</u>

Participants identified the importance of the parent involvement in creating awareness and linking to the produce markets in Oakland, California (see behavior over time graph).

From the systems thinking exercises, several insights can inform the ongoing development and sustainability of parent involvement including:

- Parent knowledge and awareness is key to their engagement in efforts to increase healthy eating (e.g., participation in produce markets) and reduce childhood obesity; this knowledge and awareness increases their skills to interact with their children through cooking meals at home as well as engaging the children in produce market activities.
- Farmers' markets have the benefit of increasing a sense of community.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

- What are some ways to assess empowerment in the community generally and specifically with respect to policy and environmental changes to support healthy eating and active living?
- How does social engagement increase sense of community, and, in turn, sense of identify? What are the key ingredients to a successful approach?

Parks & Play Spaces (Schoolyard Initiative) Feedback Loop

Given the introduction to feedback loops and CLD notation in the previous section, this discussion of the feedback loop highlighted in orange in Figure 4 expands on the concepts and notation, and highlights parks and play spaces (schoolyard initiative).

Causal Story for Feedback Loop

Story A: In this case, the story is about community engagement and collaboration to create parks and play spaces in Oakland schools. With increased community engagement and support for creating parks and play spaces, it increased inter-agency collaboration with the parks department, school district staff and board members, and school facilities and maintenance. With more inter-agency collaboration, it increased government investments made to the parks and play spaces. More investments in parks and play spaces in schools increased community pride for those spaces, and in turn, decreased crime and violence in the neighborhoods. As crime and violence decreased, more kids participated in outdoor play because they felt safe. As more kids participated in outdoor play, it continued to increase community engagement and support for parks and play spaces.

Story B: Alternatively, as community engagement and support decreased, it decreased inter-agency collaboration. With less inter-agency collaboration, there was a decrease in government investments made to the parks and play spaces. Less investments in parks and play spaces in schools decreased community pride for those spaces, and in turn, increased crime and violence in the neighborhoods. As crime and violence increased, less kids participated in outdoor play because they felt unsafe. As less kids participated in outdoor play, it continued to decrease community engagement and support for parks and play spaces.

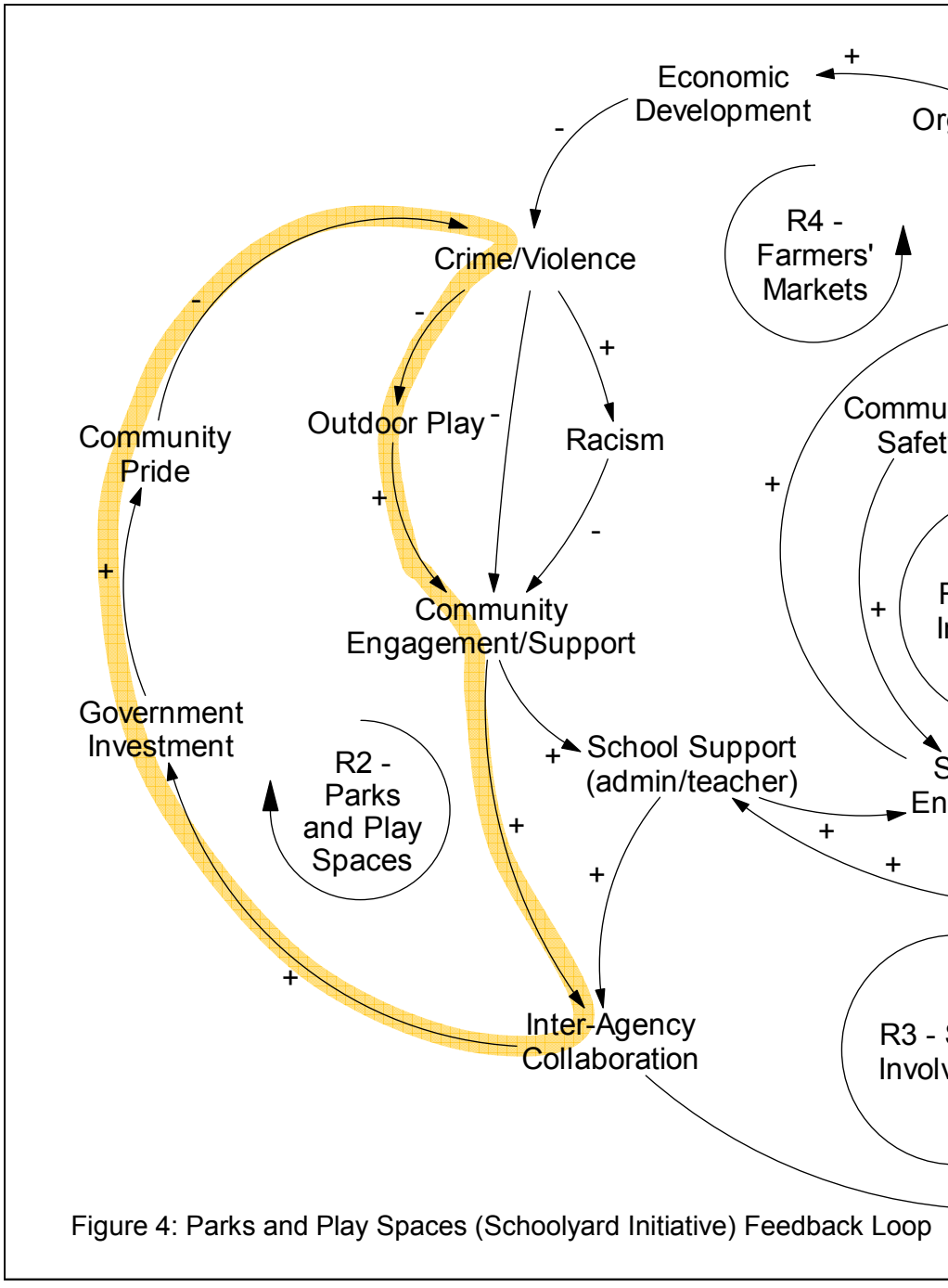


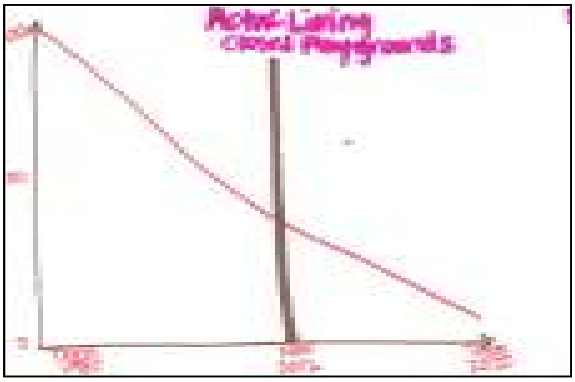
Figure 4: Parks and Play Spaces (Schoolyard Initiative) Feedback Loop

Reinforcing Loop and Notation

Unlike the parent involvement loop in Figure 3, this loop does have two "-" signs or polarities; because this is an even number, it is still a reinforcing loop (see R2—Parks and Play Spaces in Figure 4).

Some of these causal relationships may have more immediate effects (e.g., community engagement and supports influence on inter-agency collaboration) and other relationships may have delayed effects (e.g., government investments influence on community pride). This delayed effect is noted using two hash marks

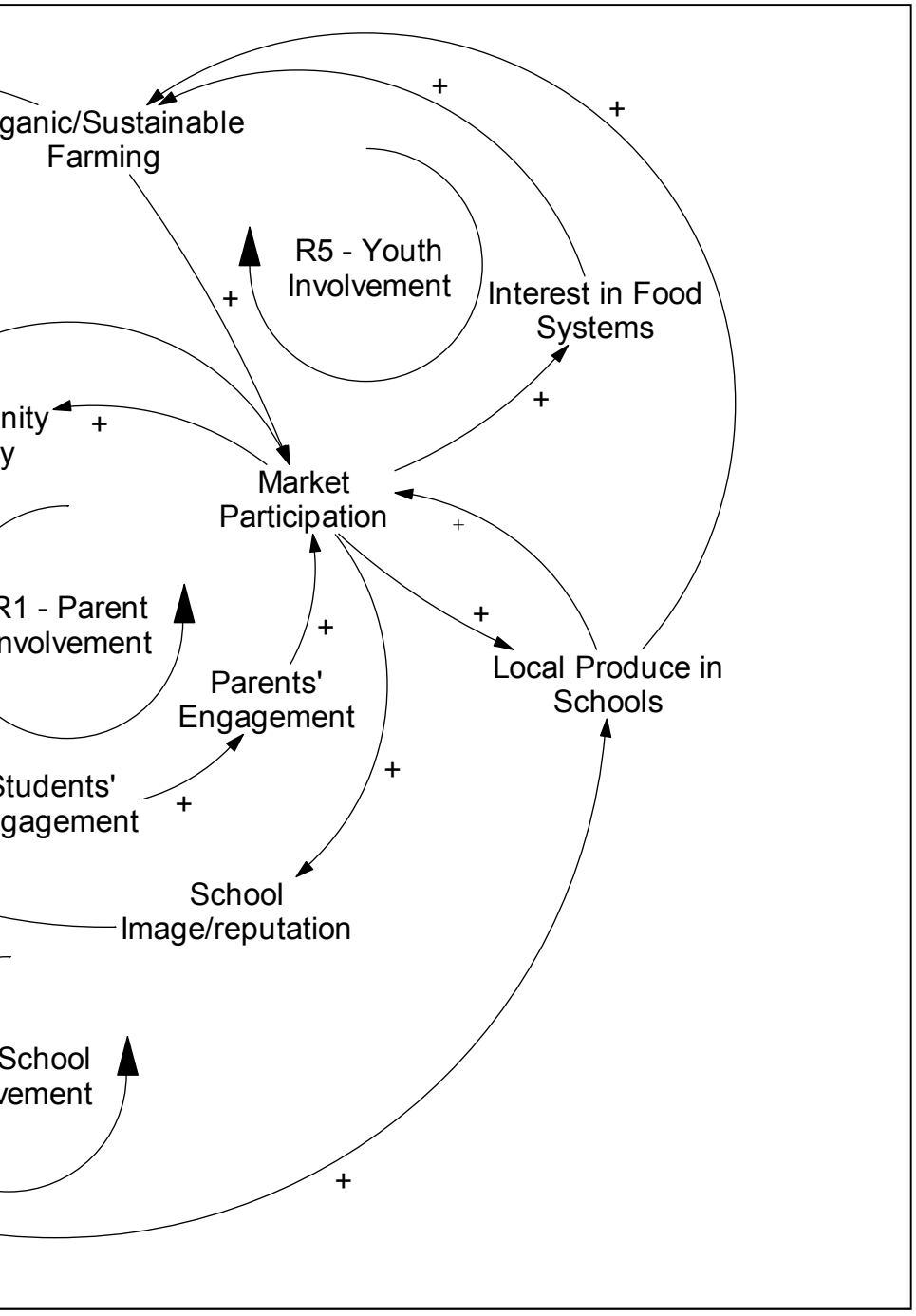
through the middle of the arrow line (not included in Figure 4).



System Insights for *Healthy Kids Oakland Partnership*

In the behavior over time graphs, participants identified the number of closed playgrounds has decreased from 1980 to 2012 with a hope that the number of closed playgrounds will continue to decrease (see top right behavior over time graph).

System insights can inform the partnership's next steps with parks and play spaces (schoolyard initiative), including:



- Integrating park design strategies and extra-curricular programs reduces youth time in gangs or violent behaviors and increases outdoor activity and community safety.
- Communities capitalize on local parks as places to convene neighbors and community representatives to advocate for changes to support access to active living resources and services in the community; these are also good places to increase voter registration (e.g., booths in the school park facilities).
- New collaborations forged with city agency representatives or community organization leaders generates more political will in various sectors of the community for those whose voices are not well represented.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

- What factors can increase employers' and policy-makers' attention to safe parks, trails, and outdoor facilities?
- How do residents' perceptions of safety influence their use of parks and play spaces?
- What factors influence neighborhood safety (e.g., rates of crime, violent actions)? Are these the same factors that influence perceptions of neighborhood safety? What are the actual rates of crime and violence as compared to perceptions?

"All the dogs in the neighborhood make it impossible for the kids to come out and play… children often say they don't go outside because it's not safe and they don't feel safe." (Participant)

School Involvement Feedback Loop

Highlighted in blue in Figure 5, the school involvement feedback loop represents one of the *Healthy Kids Oakland Partnership* strategies to increase school involvement in the produce markets in Oakland, California.

Causal Story for Feedback Loop

Story A: With more school support — particularly from administration and teachers —- it increases inter-agency collaboration including school nutrition services and facilities management. With more inter-agency collaboration, there is an increase in local produce markets in schools. As there is an increase in local produce in schools, it also increases participation in the produce markets, which increases the school image and reputation. As the school image and reputation increases, there is more school support.

Story B: Alternatively, with less school support, it decreases inter-agency collaboration. With less inter-agency collaboration, there is a decrease in local produce markets in schools. As there is less local produce in schools, it also decreases participation in the produce markets, which decreases the school image and reputation. As the school image and reputation decreases, there is less school support.

Reinforcing Loop and Notation

Similar to the previous loops, this one also represents a reinforcing loop (all "+" signs). In addition, it includes causal relationships representing more immediate effects (e.g., local produce in schools and market participation), and, potentially, delayed effects (e.g., inter-agency collaboration and local produce in schools).

Story A provides a good illustration of the reason why it is not advantageous to separate the feedback loops from the causal loop diagram (see Figures 1-2). For instance, while the school support may have an influence on inter-agency collaboration, many other factors influence school support. In this case, examining this loop without the context of the other variables and loops may lead to inappropriate conclusions.

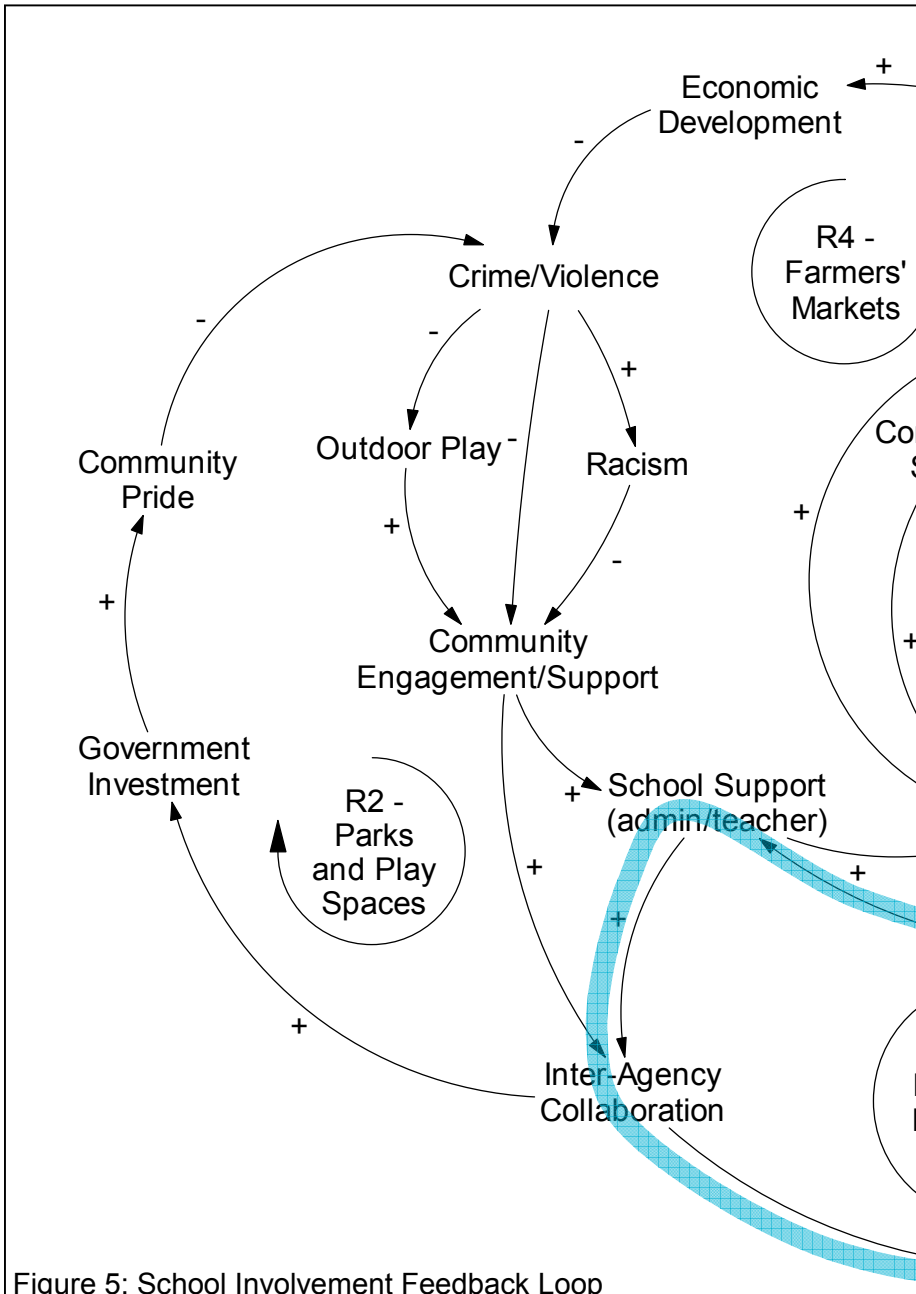
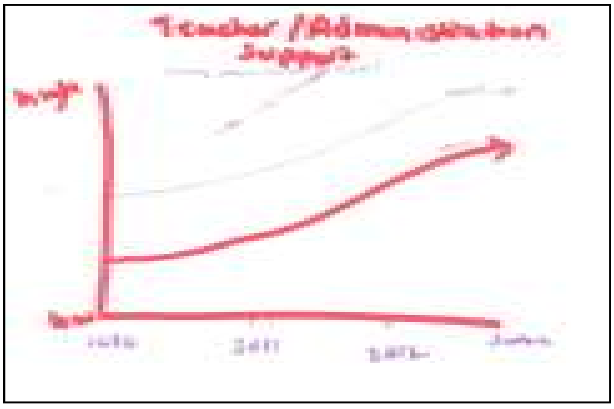


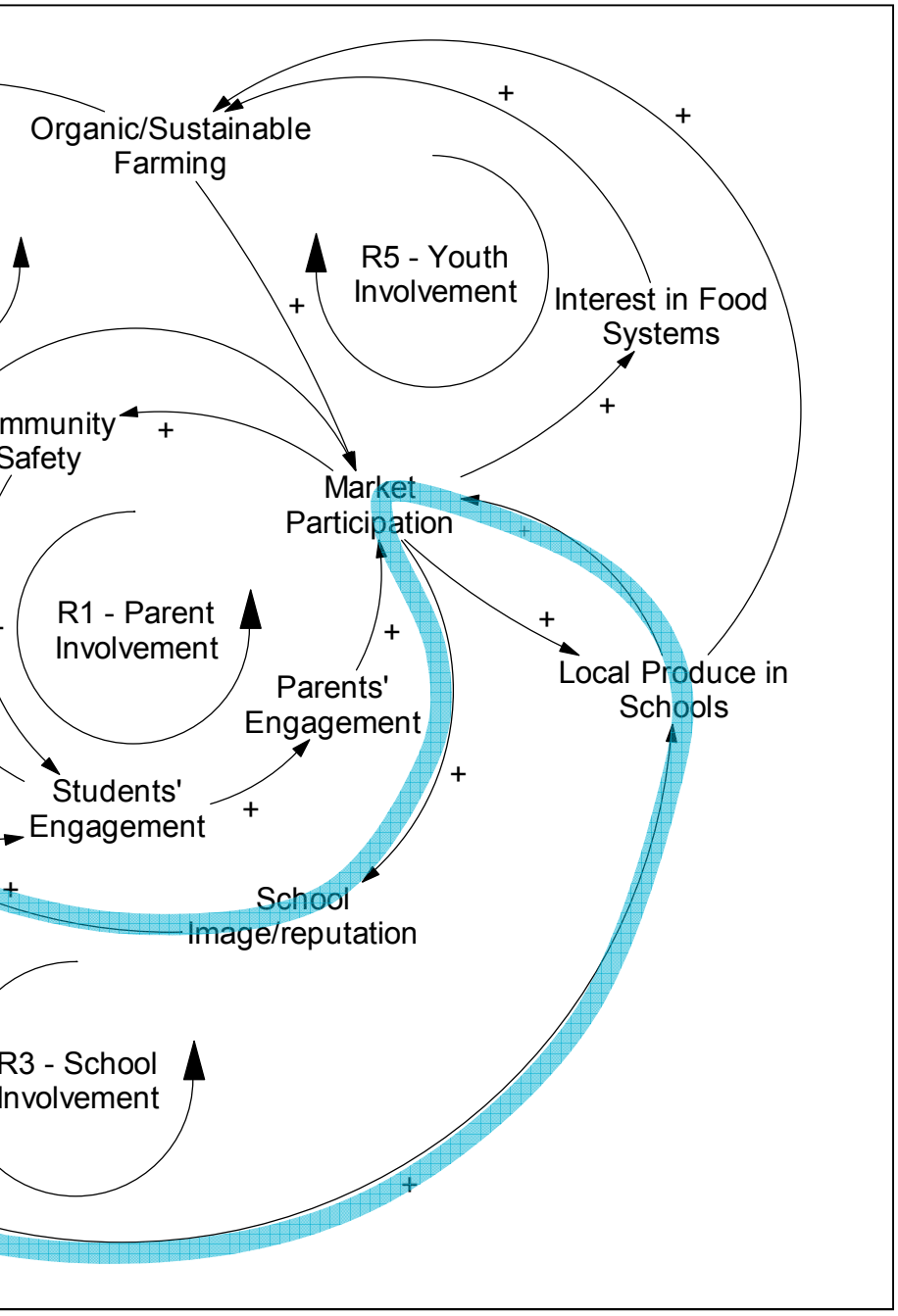
Figure 5: School Involvement Feedback Loop

"The teachers have been great; if the kids don't have money, [the teachers] will give them money for a reward of having a specific grade. We've had very generous support from teachers and administration. The orange line of the community has seen a definite increase in the amount of people coming out, stopping, and asking for produce. We also involved the senior center down the street where our principal organized children to take orders and bring the food to the senior community." (Participant)

System Insights for *Healthy Kids Oakland Partnership*

In the behavior over time graphs exercise, participants described an increase in teacher and administration support since 2010 with the hope that teacher and administration support will continue to increase. (see behavior over time graph at the top right). Participants also identified n increase in market participation since 2010 with the hope that participation





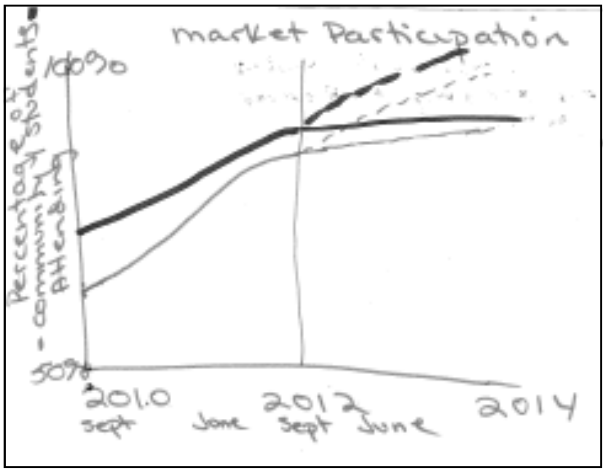
will continue to increase (see behavior over time graph bottom right).

System insights for the partnership's school involvement efforts include:

- Farmers' markets in schools have the benefit of increasing community involvement and improved the school's support and reputation.
- Parent knowledge and awareness is key to their engagement in efforts to increase healthy eating and active living and reduce childhood obesity; this knowledge and awareness increases their skills to interact with their children through cooking meals at home or engaging in physical activity.
- New collaborations forged with city agency representatives or community organization leaders generates more political will in various sectors of the community for those whose voices are not well represented.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

- What is the quantity and quality of food vendors within a one-mile radius of schools (e.g., access to fruits and vegetables, access to junk foods)?
- What drives community collaboration when funding support is not available?



Farmers' Market (School Produce Markets) Feedback Loop

Highlighted in red in Figure 6, the farmers' market (school produce markets) feedback loop represents one of the *Healthy Kids Oakland Partnership* strategies to increase healthy eating in Oakland, California.

Causal Story for Feedback Loop

Story A: With more local produce available in schools, it increases the interest in organic and sustainable farming practices. With more organic and suitable farming, there is an increase in economic development opportunities (e.g., more farming jobs). With more economic development, there is a decrease in crime and violence which decreases racism. With decreased racism, there is more community engagement and support particularly from minority populations. With more community engagement and support there is more school support from administrators and teachers, and in turn, more student engagement. With more student engagement, there is more participation in the produce markets, which increases the local produce in schools.

Story B: Alternatively, with less local produce available in schools, it decreases the interest in organic and sustainable farming practices. With less organic and suitable farming, there is a decrease in economic development opportunities (e.g., less farming jobs). With less economic development, there is an increase in crime and violence which increases racism. With increased racism, there is less community engagement and support particularly from minority populations. With less community engagement and support there is less school support from administrators and teachers, and in turn, less student engagement. With less student engagement, there is less participation in the produce markets, which decreases the

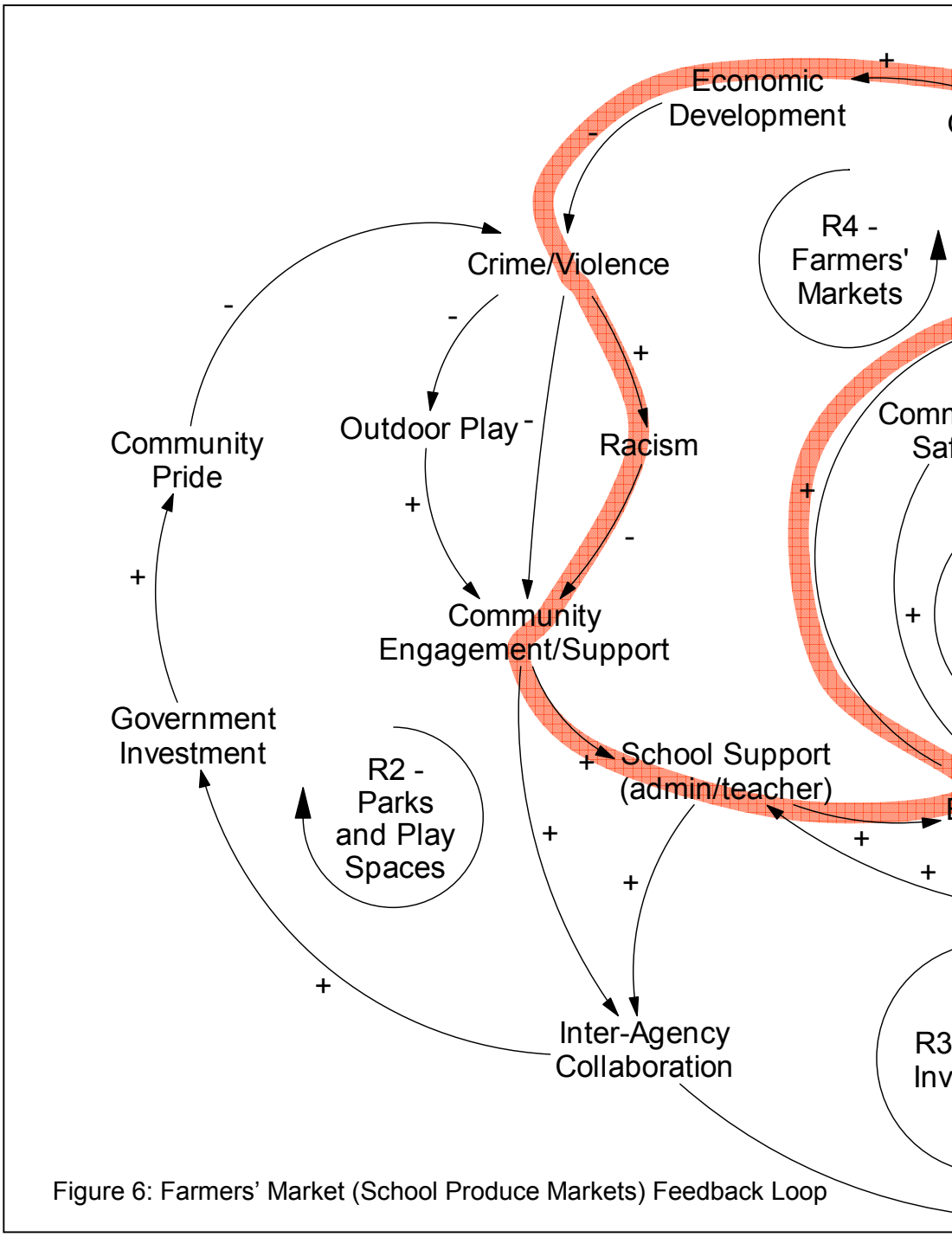


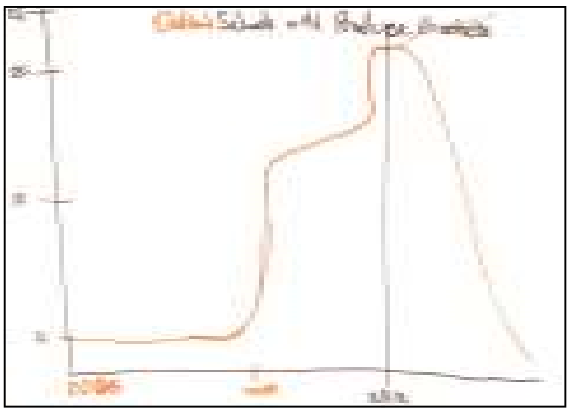
Figure 6: Farmers' Market (School Produce Markets) Feedback Loop

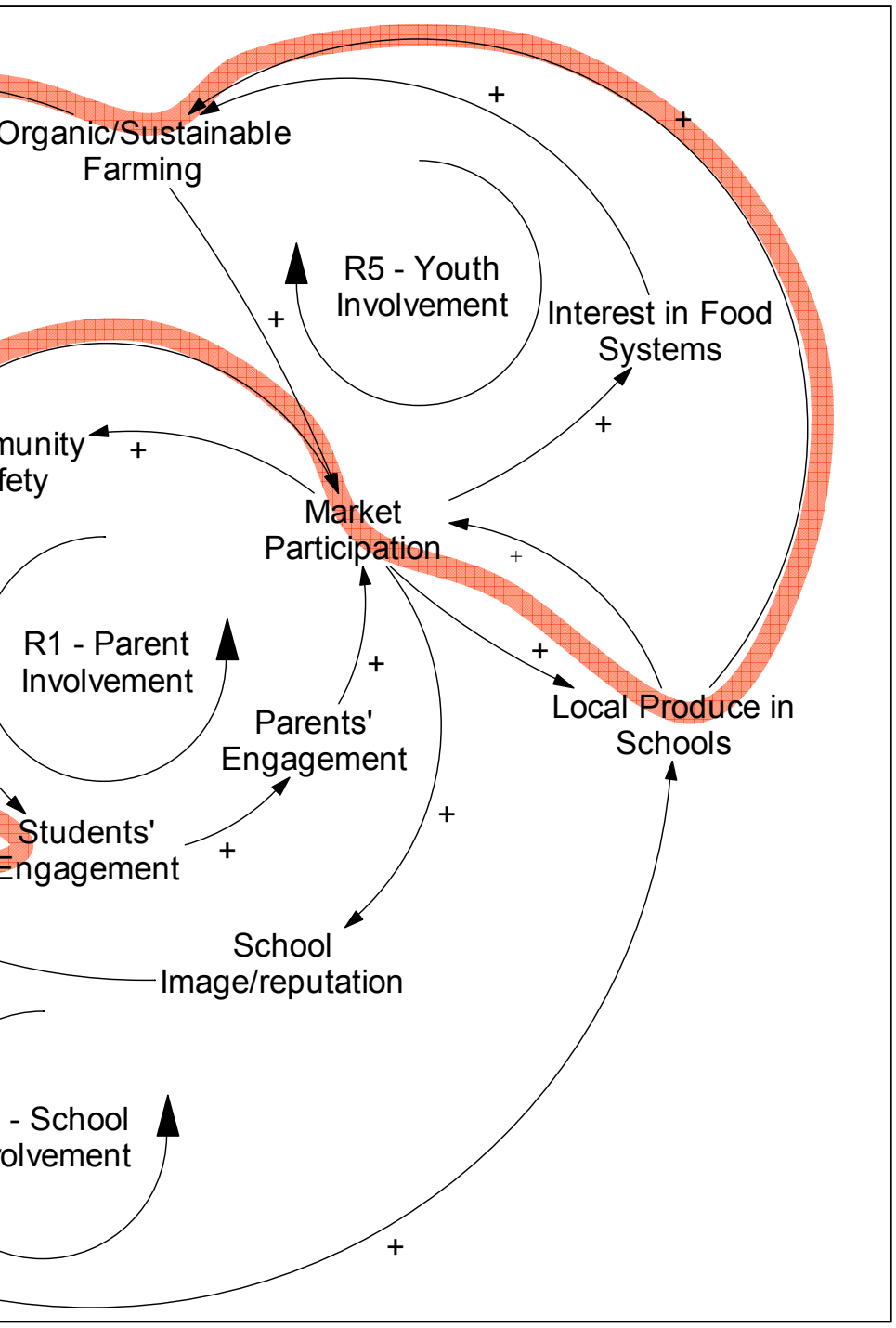
"At that younger age group, kids are still developing and growing and so to influence them would be so critical later on. Carrying on those deep roots of healthy eating and active living even if they are influenced differently, they know that deep down it's best to nourish themselves in a whole, non-processed, more fresh fruit and vegetable method." (Participant)

local produce in schools.

Reinforcing Loop and Notation

Similar to the previous loops (see Figure 3 & 4), this is a reinforcing loop (two or an even number of "-" signs). In addition, it includes causal relationships representing more immediate effects (e.g., students engagement and market participation), and, potentially, delayed effects (e.g., economic development and crime/violence).



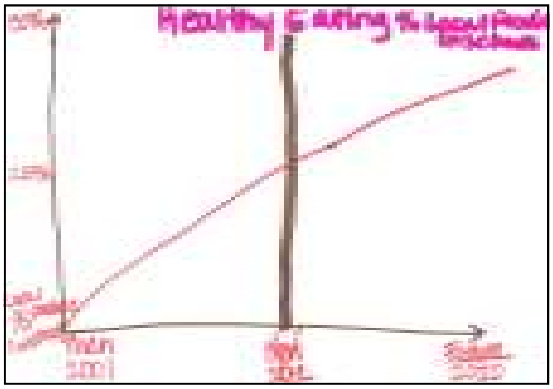


System Insights for *Healthy Kids Oakland Partnership*

In the behavior over time graphs exercise, participants described increase in Oakland Schools with produce markets since 2006 with the hope that the number of produce markets in Oakland Schools will continue to increase. (see behavior over time graph at the top right). Additionally, participants also described an increase in the percentage of local healthy eating occurring in schools since 2001 with the hope that healthy eating in schools will continue to increase. (see behavior over time graph at the bottom right).

System insights for the partnership's farmers' market (school produce markets) efforts include:

- Farmers' markets have the benefit of increasing a sense of community and produce markets in schools have increased sense of community, community pride, and support from school personnel.
- Collaborations forged with city agencies, school representatives or community organization leaders generates more political will in various sectors of the community for those whose voices are not well represented.



Youth Involvement Feedback Loop

Highlighted in yellow in Figure 7, the youth involvement feedback loop represents one of the *Healthy Kids Oakland* strategies to increase community engagement in Oakland, California.

Causal Story for Feedback Loop

Story A: With more student engagement, it increases market participation. With more market participation, there is more interest in food systems. With more interest in food systems, there is an increase in organic and sustainable farming, which is increasing economic development (e.g., jobs for farmers, distributers, retailers). As economic development increases, there is a decrease in crime and violence which decreases racism. With decreased racism, there is more community engagement and support particularly from minority populations. With more community engagement and support there is more school support from administrators and teachers, and in turn, more student engagement.

Story B: Alternatively, with less student engagement, it decreases market participation. With less market participation, there is less interest in food systems. With less interest in food systems, there is a decrease in organic and sustainable farming, which decreases economic development. As economic development decreases, there is a more crime and violence which increases racism. With increased racism, there is less community engagement and support particularly from minority populations. With less community engagement and support there is less school support from administrators and teachers, and in turn, less student engagement.

Reinforcing Loop and Notation

Similar to the previous loops (see Figure 3-6), this is a reinforcing loop (two or an even number of "-" signs). In addition, it includes causal relationships representing more immediate effects (student engagements influence on market participation) and, potentially, delayed effects (e.g., economic developments influence on crime/violence).

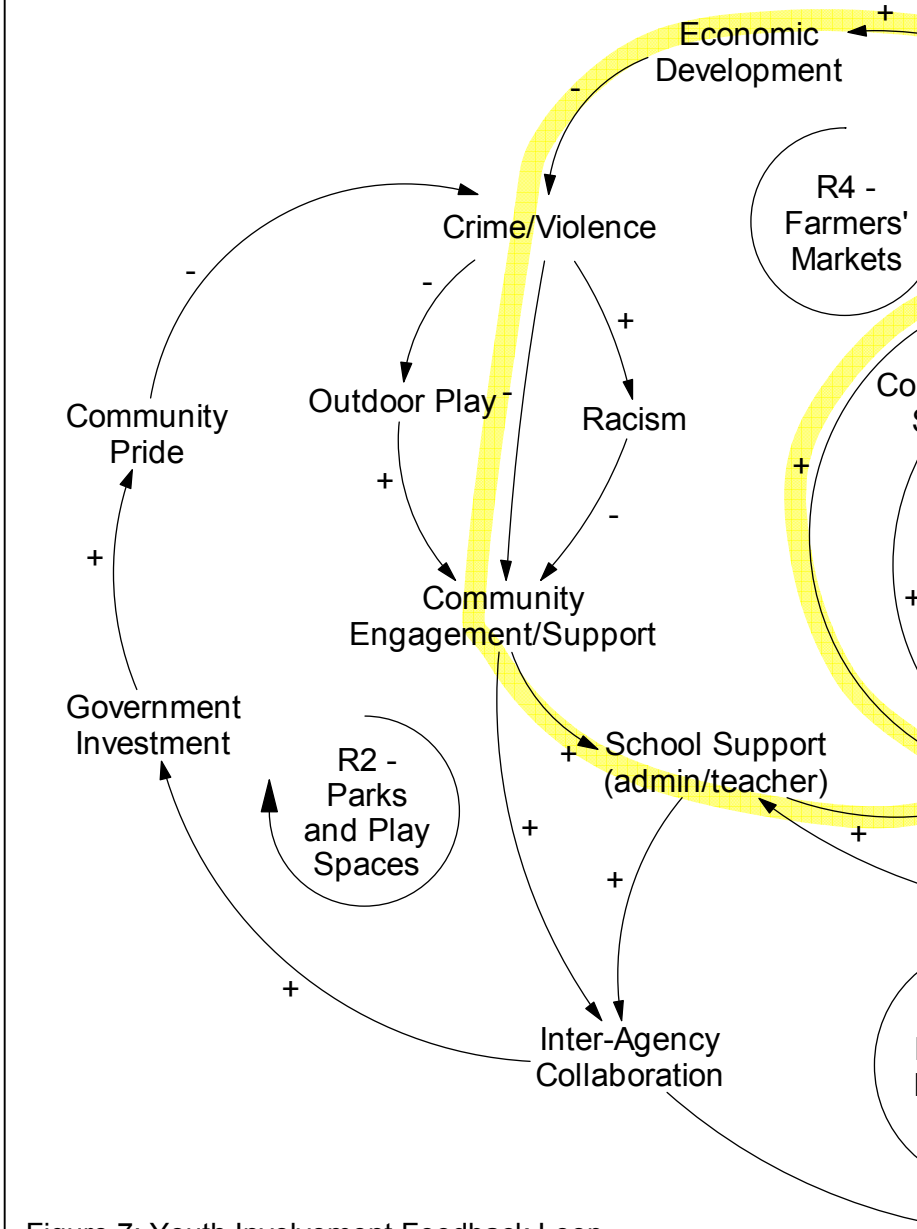
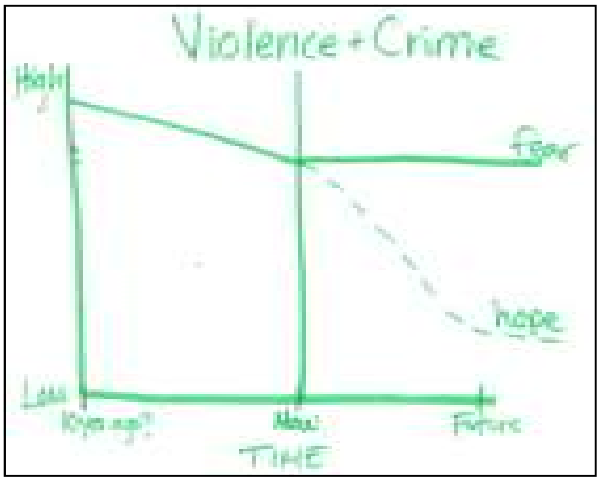


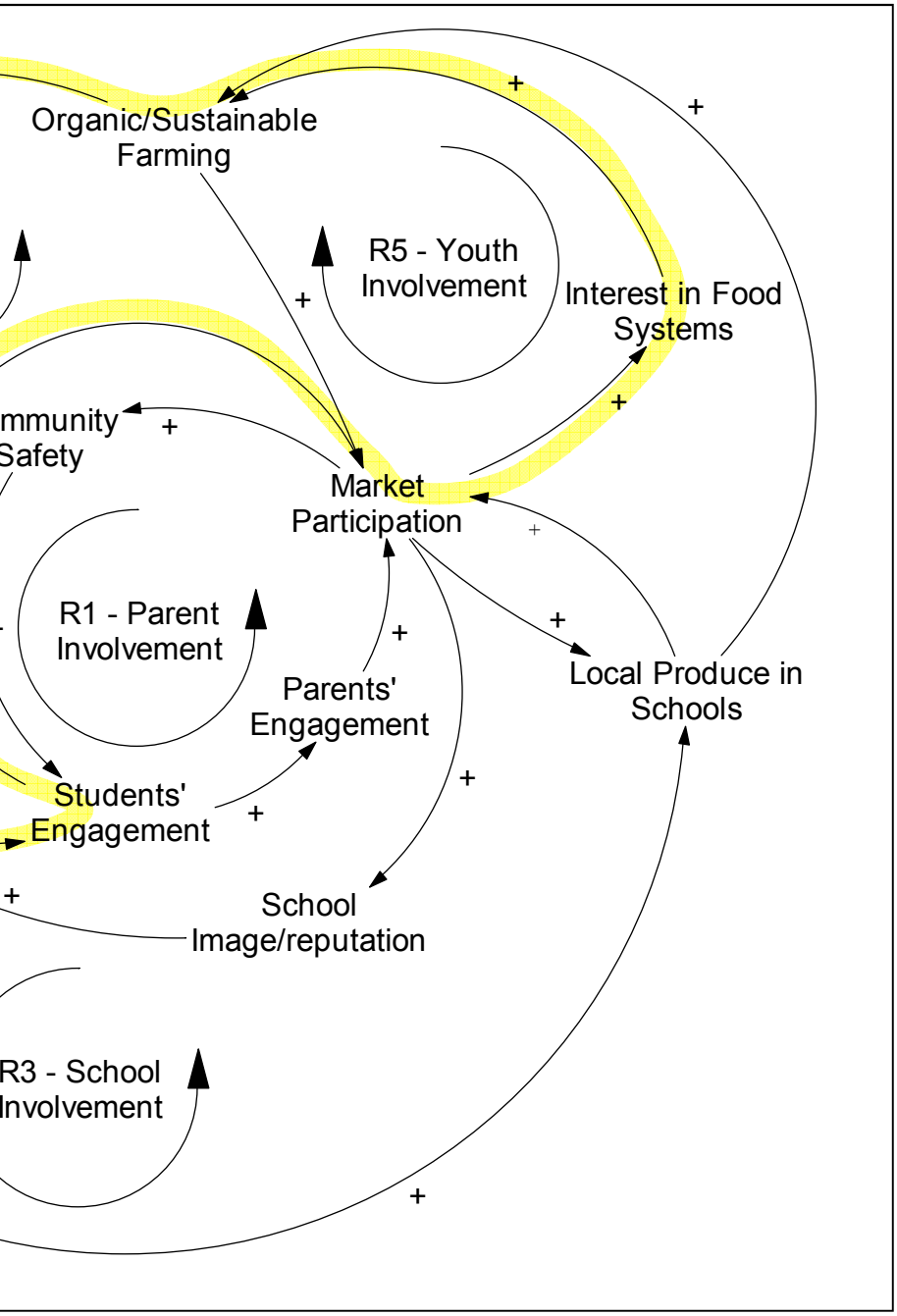
Figure 7: Youth Involvement Feedback Loop

"[In terms of linking] the market with the curriculum and the classroom, my colleagues were really successful in the percentage of curriculum—reading, math, science—increasing as the market became more and more popular. We had a community garden and the teachers would bring the children out to show where and how the food was grown and cultivated. The technology teacher had a question of the week on doing research on the computer about the produce that was sold in the market that month…In math class, after students purchased produce, they would come back to the classroom and create graphs on how many people chose apples or pears and do the tally marks. It just became a whole part of our school culture." (Participant)

System Insights for *Healthy Kids Oakland Partnership*

In the behavior over time graphs exercise, participants described a slight decrease in crime and violence since 10 years ago (i.e., 2002) with the hope that the variable will more dramatically decline (see behavior over time graph at the top right). However, participants also described a previous drop with a recent increase in organic and sustainable farming from the past to present with the hope that organic and sustainable farming will continue to increase (see behavior over time graph at the bottom right).



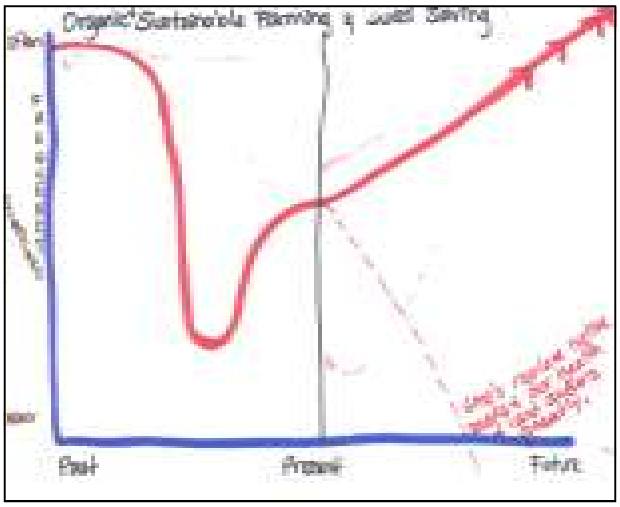


System insights for the partnership's youth involvement efforts include:

- Jobs are an essential ingredient to creating equity (reducing disparities and discrimination), safety, and a stable economy.
- Students gain social benefits from interacting with other students, parents, school staff, or neighbors while participating in the produce markets at school.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

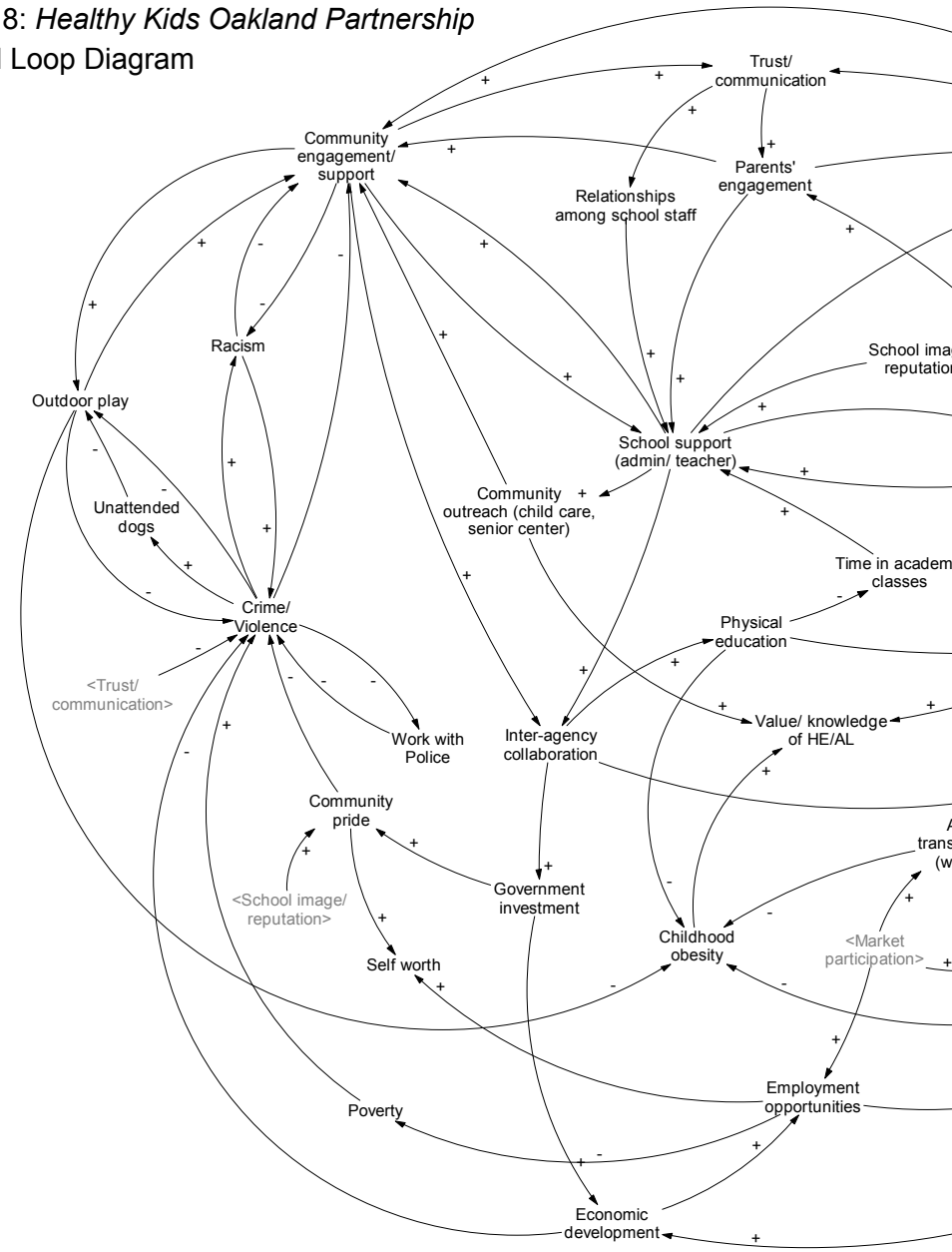
- What is the optimal number of school produce markets for a neighborhood or urban area?
- What is the potential for local food production given the vacant urban lots available for agriculture? What development patterns will sustain the ability to meet these food production requirements into the future?



Opportunities for Systems Thinking in Oakland, California

This storybook provided an introduction to some basic concepts and methods for systems thinking at the community level, including: causal loop diagrams, variables and shadow variables, causal relationships and polarities, reinforcing feedback loops, and balancing feedback loops, among others. For the *Healthy Kids Oakland Partnership*, this storybook also summarized the healthy eating, active living, partnership and community capacity, social determinants, and health and health behaviors subsystems in the Oakland causal loop diagram as well as six specific feedback loops corresponding to the partnership's primary strategies.

Figure 8: *Healthy Kids Oakland Partnership* Causal Loop Diagram



This causal loop diagram reflects a series of conversations among partners and residents from 2011 to 2013. Some discussions probed more deeply into different variables through the behavior over time graphs exercise, or causal relationships through the causal loop diagram exercise.

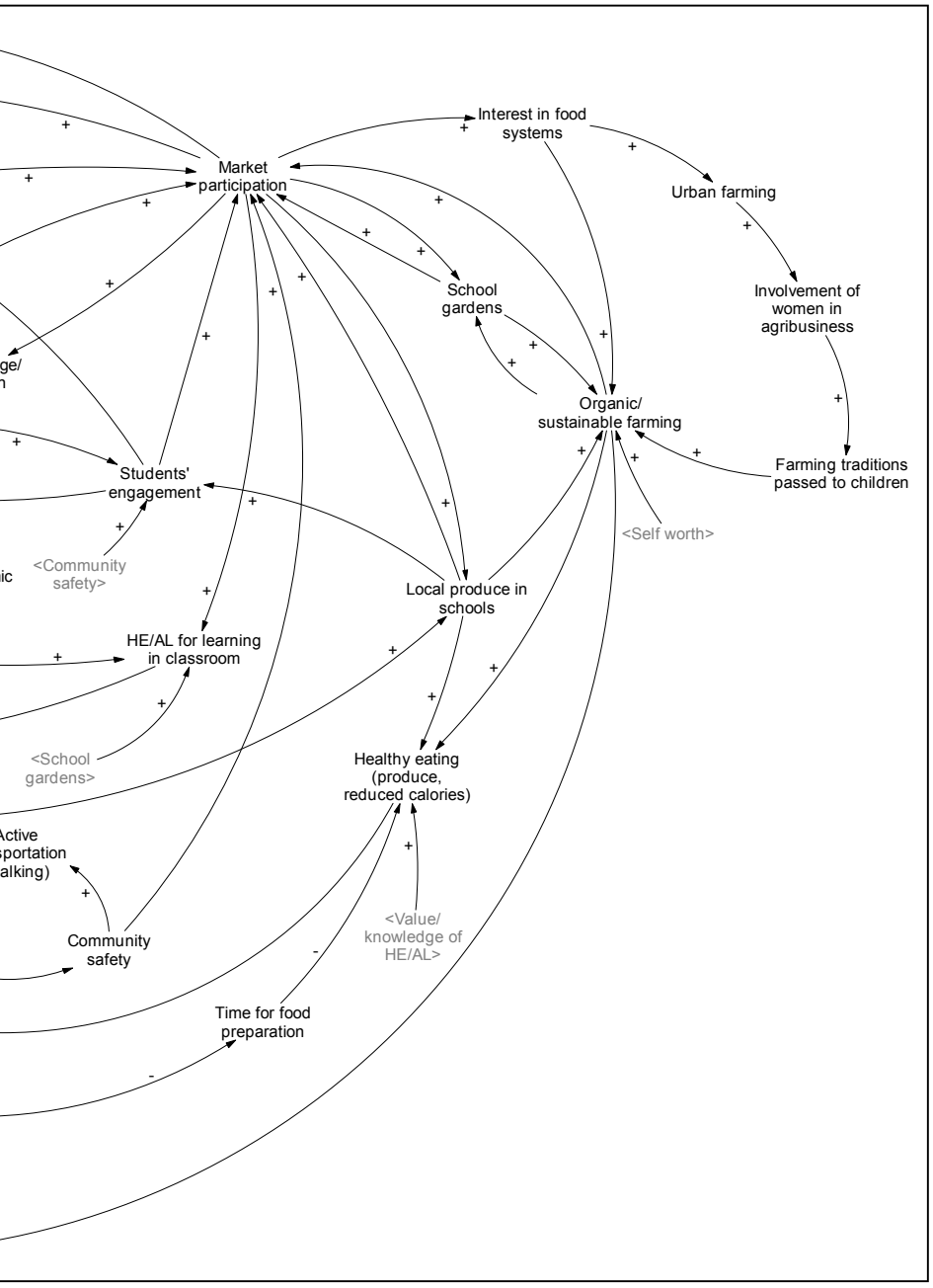
This represented a first attempt to collectively examine the range of things that affect or are affected by policy, system, and environmental changes in Oakland, California to promote healthy eating and active living as well as preventing childhood overweight and obesity.

Yet, there are several limitations to this storybook, including:

- the participants represent a sample of the *Healthy Kids Oakland Partnership* (organizations and residents) as opposed to a representative snapshot of government agencies, community organizations, businesses, and community residents;
- the behavior over time graphs and the causal loop diagram represent perceptions of the participants in these exercises (similar to a survey or an interview representing perceptions of the respondents);
- the exercises and associated dialogue took place in brief one- to two-hour sessions, compromising the group's capacity to spend too much time on any one variable, relationship, or feedback loop; and
- the responses represent a moment in time so the underlying structure of the diagram and the types of feedback represented may reflect "hot button" issues of the time.

Much work is yet to be done to ensure that this causal loop diagram is accurate and comprehensive, for example:

- having conversations to discuss existing feedback loops to ensure that the appropriate variables and relationships are represented accurately;
- reviewing the behavior over time graphs (see also Appendix E) to confirm that the trends reflect common perceptions among residents and compare these trends to actual data;



- revisiting variables removed because they were not part of feedback loops, including consumerism, bullying; safety of parks/recreation facilities; availability of junk food; food preparation on TV; focus on prevention; number of schools serving breakfast; focus on academics; government system efficiency; safety of parks/recreation facilities; car dependence; genetically modified organisms & seeds; seed saving; access to school produce markets; publicity; funding for supplemental school programs; pollution and waste; health wellness communities of color; coolness of home cooking; NGO investment; homeless individuals; practical learning; support of the whole child in education; and
- starting new conversations about other variables (behavior over time graphs exercise) or relationships (causal loop diagram exercise) to add to this diagram.

In addition, different subgroups in Oakland may use this causal loop diagram to delve in deeper into some of the subsectors (e.g., healthy eating, active living) or feedback loops, creating new, more focused causal loop diagrams with more specific variables and causal relationships.

Use of more advanced systems science methods and analytic approaches to create computer simulation models is another way to take this early work to the next level. The references section includes citations for resources on these methods and analytic approaches, and it is necessary to engage professional systems scientists in these activities.

Please refer to the Appendices for more information, including:

- Appendix A: Behavior over time graphs generated during site visit
- Appendix B: Photograph of the original version of the *Healthy Kids Oakland Partnership* Causal Loop Diagram
- Appendix C: Original translation of the causal loop diagram into Vensim PLE
- Appendix D: Transcript translation of the causal loop diagram into Vensim PLE
- Appendix E: Behavior over time graphs not represented in the storybook

References for Systems Thinking in Communities:

Group model building handbook:
Hovmand, P., Brennan L., & Kemner, A. (2013). Healthy Kids, Healthy Communities Group Model Building Facilitation Handbook. Retrieved from http://www.transtria.com/hkhc.

Vensim PLE software for causal loop diagram creation and modification:
Ventana Systems. (2010). Vensim Personal Learning Edition (Version 5.11A) [Software]. Available from http://vensim.com/vensim-personal-learning-edition/

System dynamics modeling resources and support:
Andersen, D. F. and G. P. Richardson (1997). "Scripts for group model building." System Dynamics Review 13(2): 107-129.

Hovmand, P. (2013). Community Based System Dynamics. New York, NY: Springer.

Hovmand, P. S., et al. (2012). "Group model building "scripts" as a collaborative tool." Systems Research and Behavioral Science 29: 179-193.

Institute of Medicine (2012). An integrated framework for assessing the value of community-based prevention. Washington, DC, The National Academies Press.

Meadows, D. (1999). Leverage points: places to intervene in a system. Retrieved from http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/

Richardson, G. P. (2011). "Reflections on the foundations of system dynamics." System Dynamics Review 27 (3): 219-243.

Rouwette, E., et al. (2006). "Group model building effectiveness: A review of assessment studies." System Dynamics Review 18(1): 5-45.

Sterman, J. D. (2000). Business dynamics: Systems thinking and modeling for a complex world. New York, NY: Irwin McGraw-Hill.

System Dynamics in Education Project. (1994). Road maps: A guide to learning system dynamics. Retrieved from http://www.clexchange.org/curriculum/roadmaps/

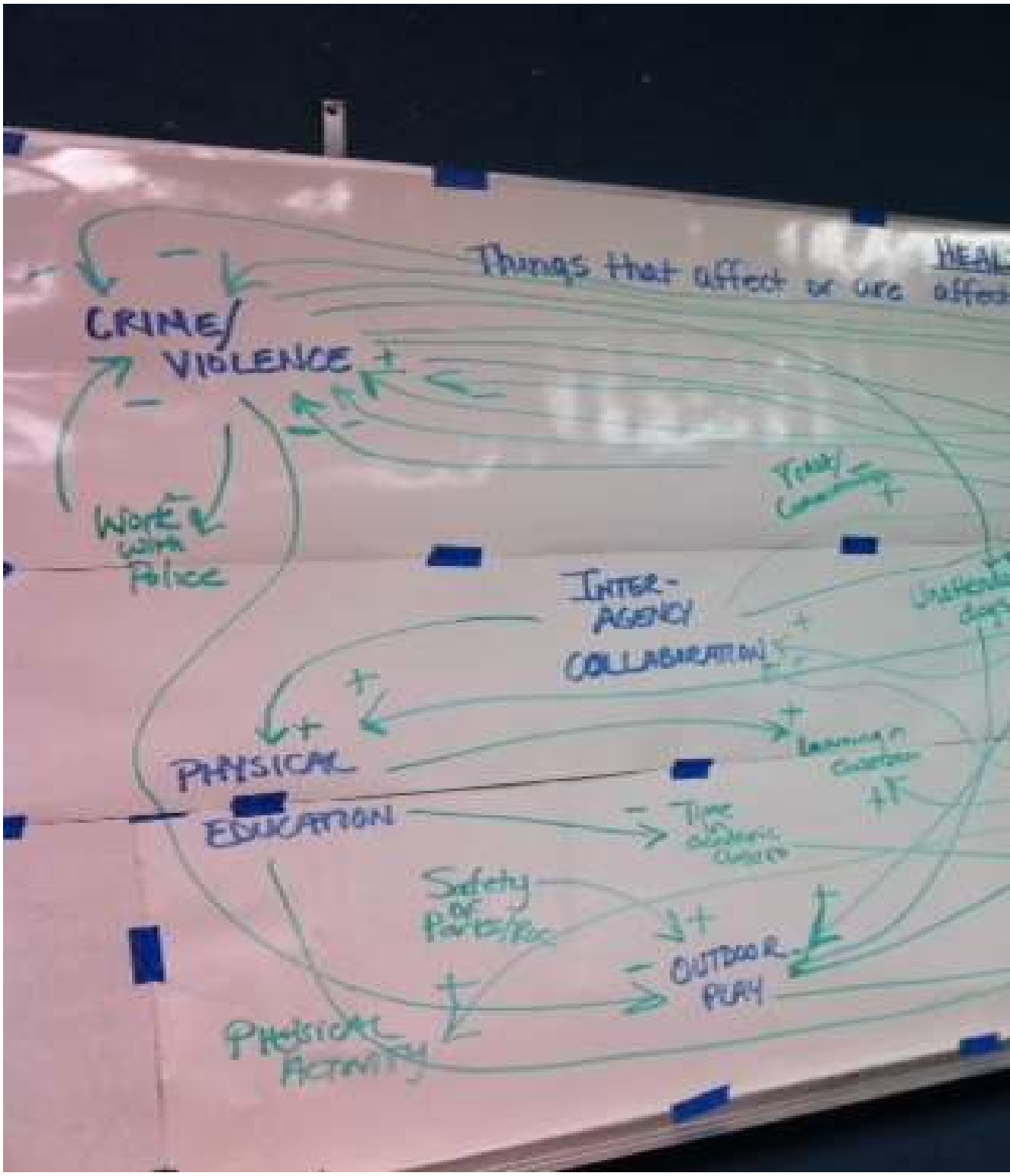
Vennix, J. (1996). Group model building. New York, John Wiley & Sons.

Zagonel, A. and J. Rohrbaugh (2008). Using group model building to inform public policy making and implementation. Complex Decision Making. H. Qudart-Ullah, J. M. Spector and P. I. Davidsen, Springer-Verlag: 113-138.

Appendix A: Behavior Over Time Graphs Generated during Site Visit

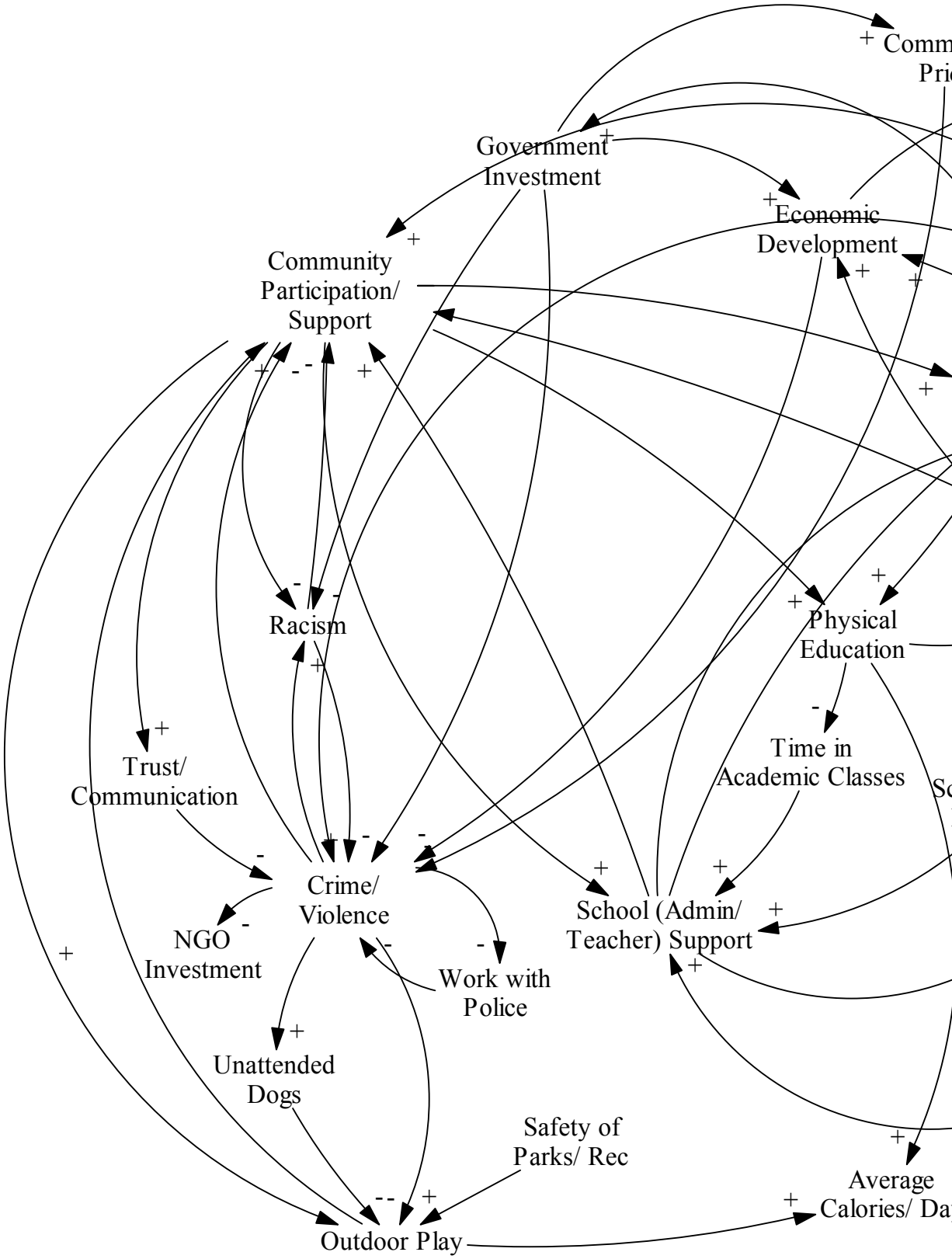
Oakland, California: *Healthy Kids Oakland Partnership*	
Categories	**Number of Graphs**
Active Living Behavior	3
Active Living Environments	1
Funding	1
Healthy Eating Behavior	2
Healthy Eating Environments	6
Marketing and Media Coverage	0
Obesity and Long Term Outcomes	2
Partnership & Community Capacity	5
Policies	0
Programs & Promotions (Education and Awareness)	4
Social Determinants of Health	7
Total Graphs	**31**

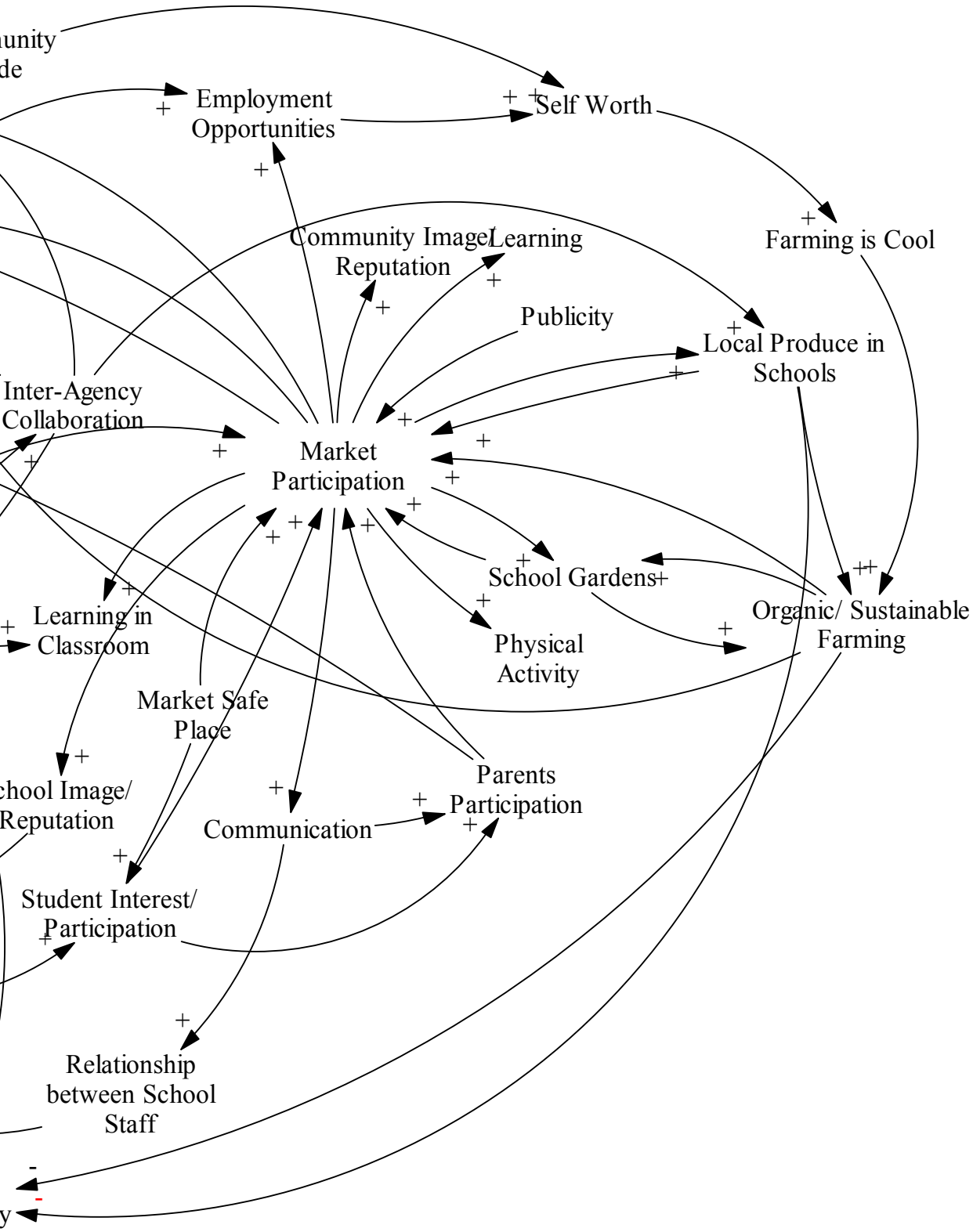
Appendix B: Photograph of the Original Version of the <*CP name*> Causal Loop Diagram



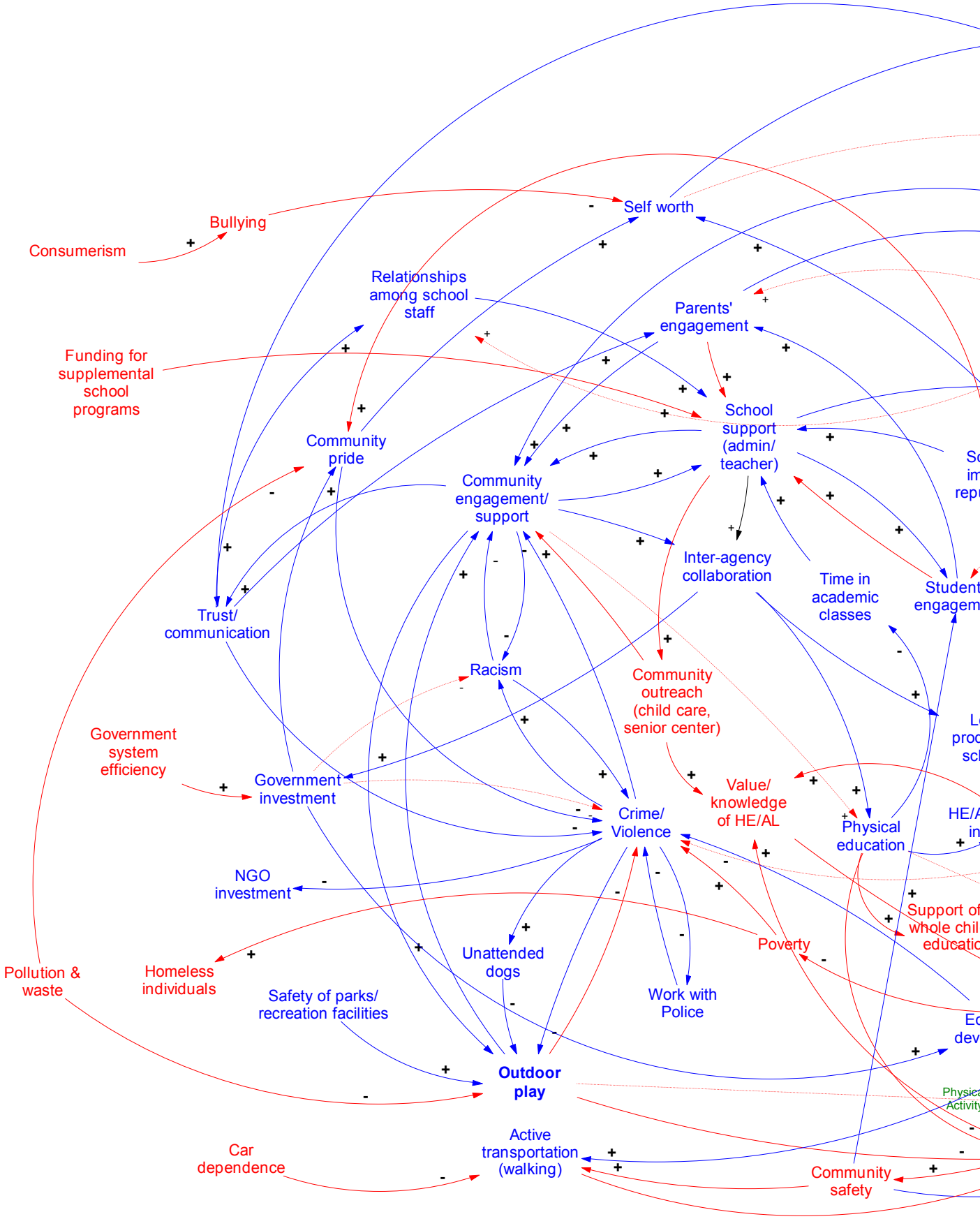

RACISM

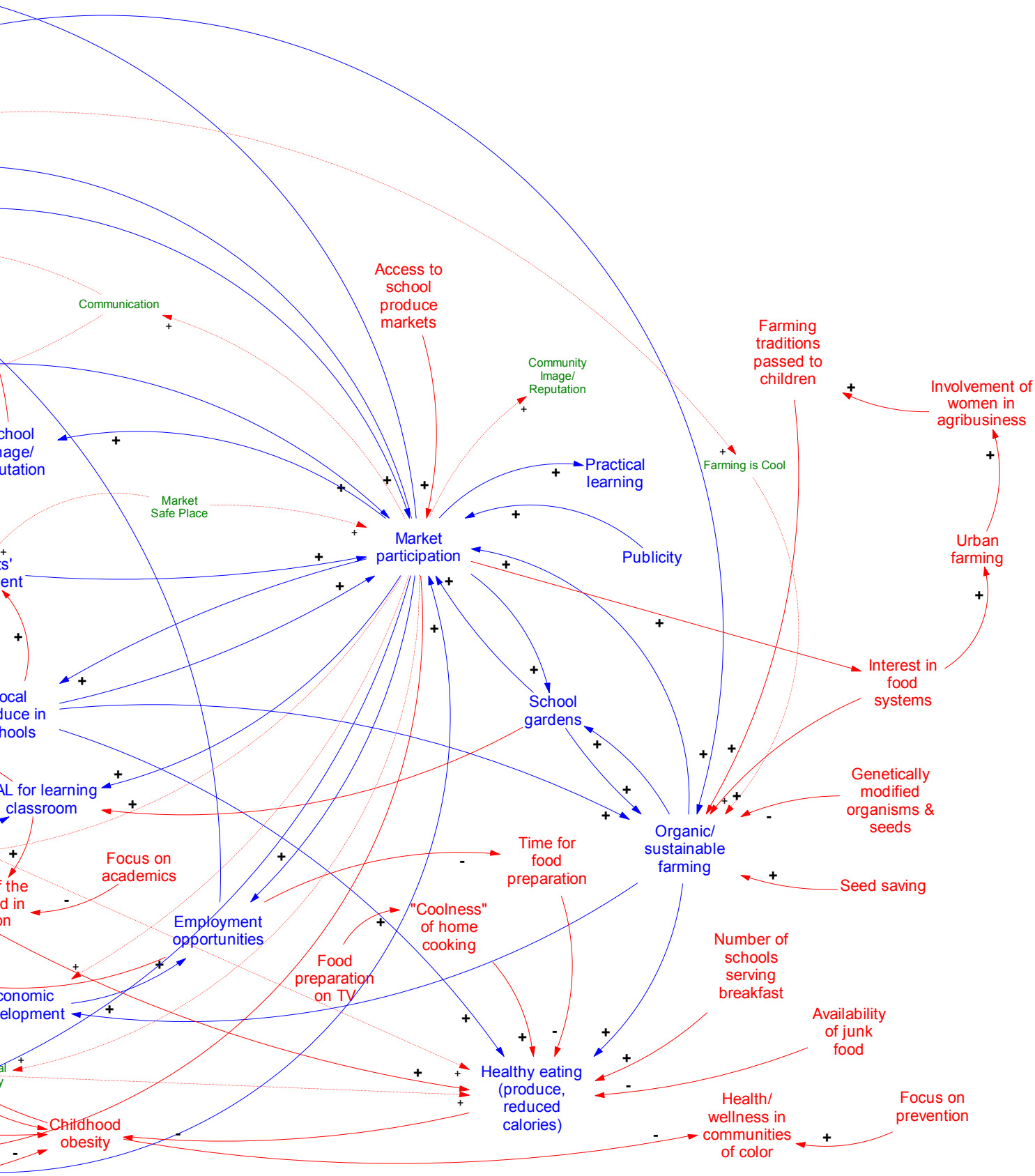
Appendix C: Original Translation of the Causal Loop Diagram into Vensim PLE



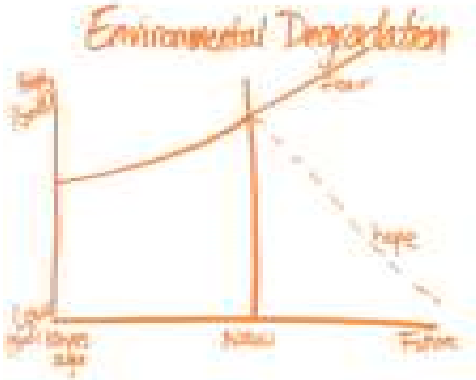

unity
de
Employment
Opportunities
Self Worth
Farming is Cool
Community Image/
Reputation
Learning
Publicity
Local Produce in
Schools
Inter-Agency
Collaboration
Market
Participation
School Gardens
Organic/ Sustainable
Farming
Learning in
Classroom
Physical
Activity
Market Safe
Place
Parents
Participation
chool Image/
Reputation
Communication
Student Interest/
Participation
Relationship
between School
Staff
y

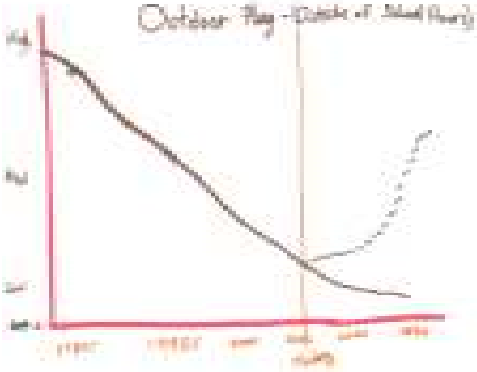
Appendix D: Transcript Translation of the Causal Loop Diagram into Vensim PLE

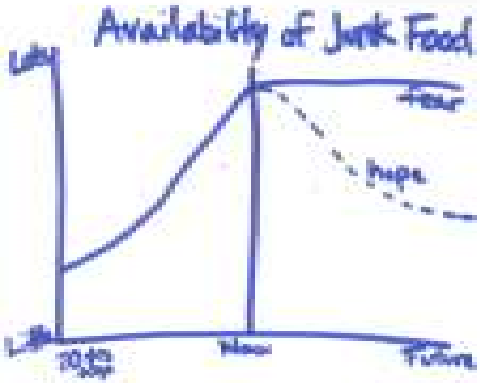


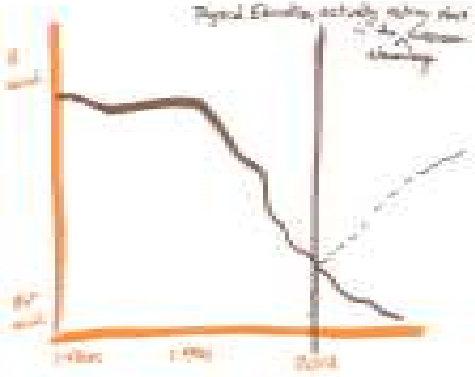

Access to school produce markets
Communication
Community Image/ Reputation
Farming traditions passed to children
Involvement of women in agribusiness
Practical learning
Farming is Cool
Market Safe Place
Market participation
Publicity
Urban farming
Interest in food systems
School gardens
Genetically modified organisms & seeds
Organic/ sustainable farming
Time for food preparation
Focus on academics
Seed saving
Employment opportunities
"Coolness" of home cooking
Food preparation on TV
Number of schools serving breakfast
Availability of junk food
Healthy eating (produce, reduced calories)
Childhood obesity
Health/ wellness in communities of color
Focus on prevention

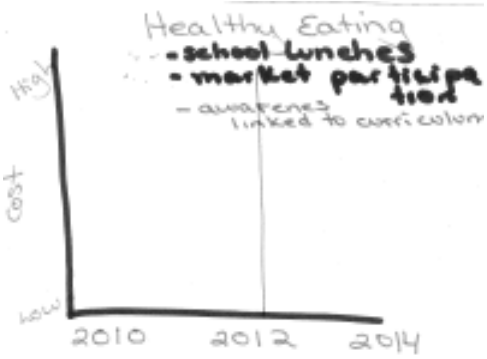
Appendix E: Behavior Over Time Graphs not Represented in the Storybook

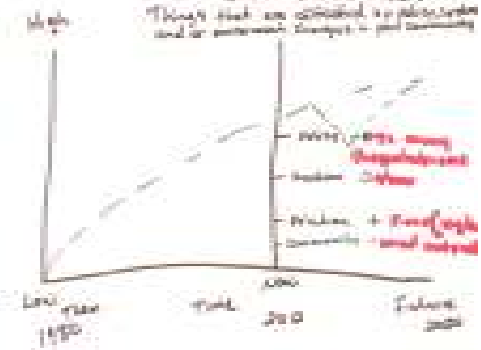


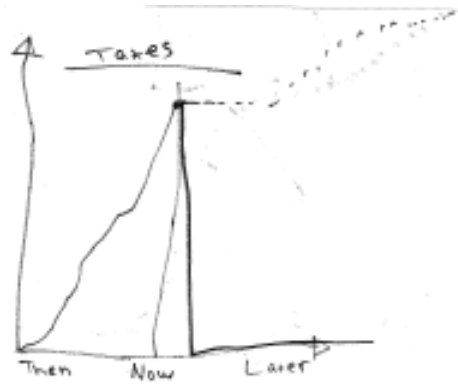


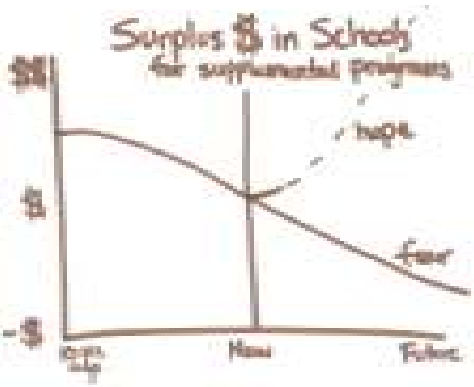


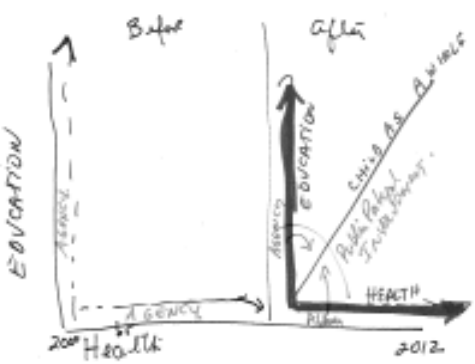


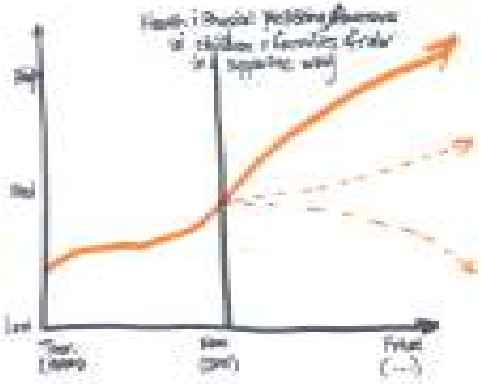






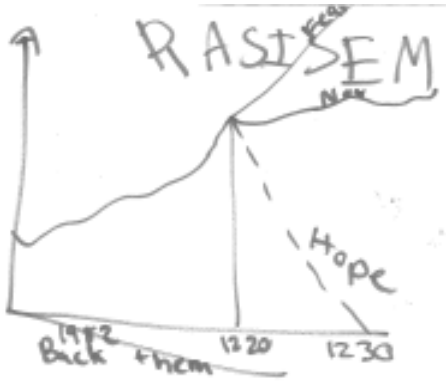


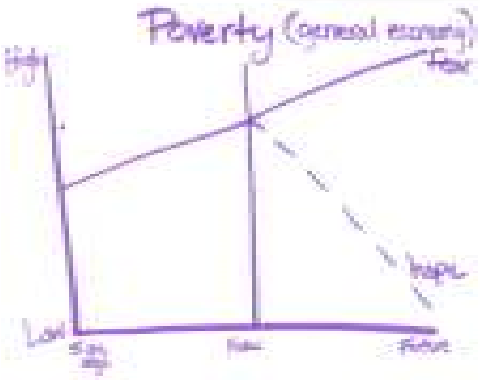


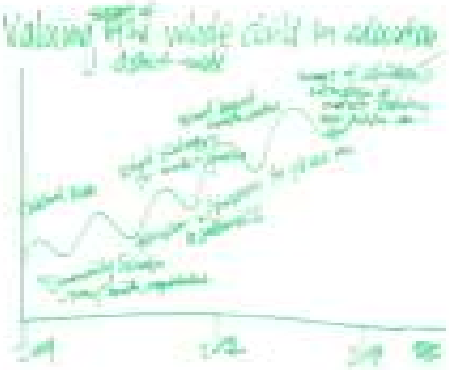


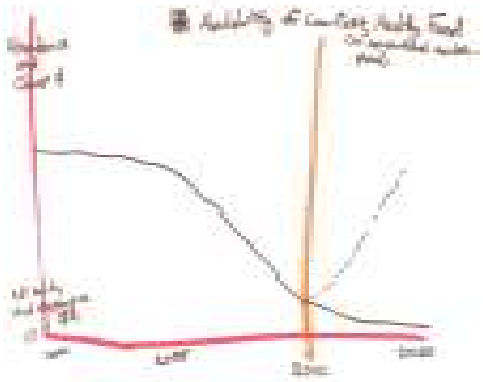

obesity (CDC)


EATING / CONSUMPTION

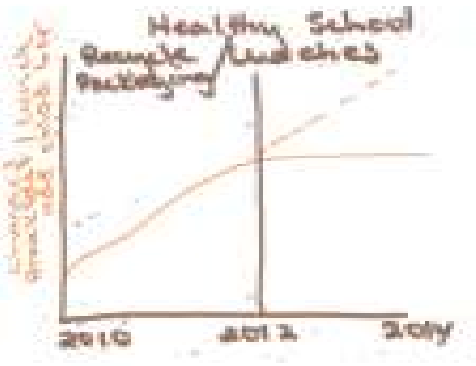

RASISEM
Hope
1992
Back
1220
1230

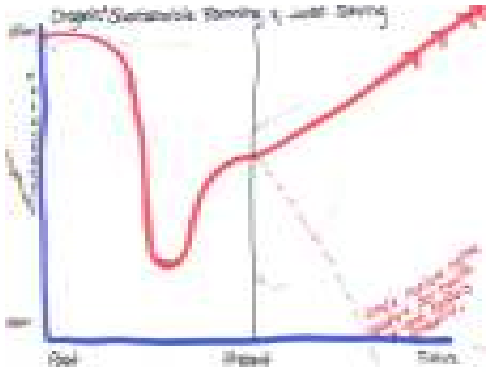

Poverty (general economy)
Hope
Low

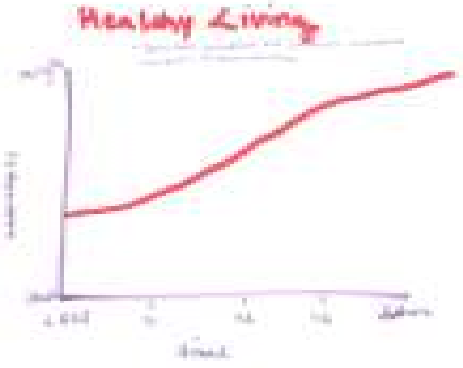





Homeless
Hope
Past
Present
Future


Healthy School




Healthy Living

Appendix E (continued): Behavior Over Time Graphs not Represented in the Storybook