Supplementary Material

Model Documentation for
Enabling Mobility: A Simulation Model of the Health Care System for Major Lower-Limb Amputees to Assess the Impact of Digital Prosthetics Services

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Health Care System: Population Sector

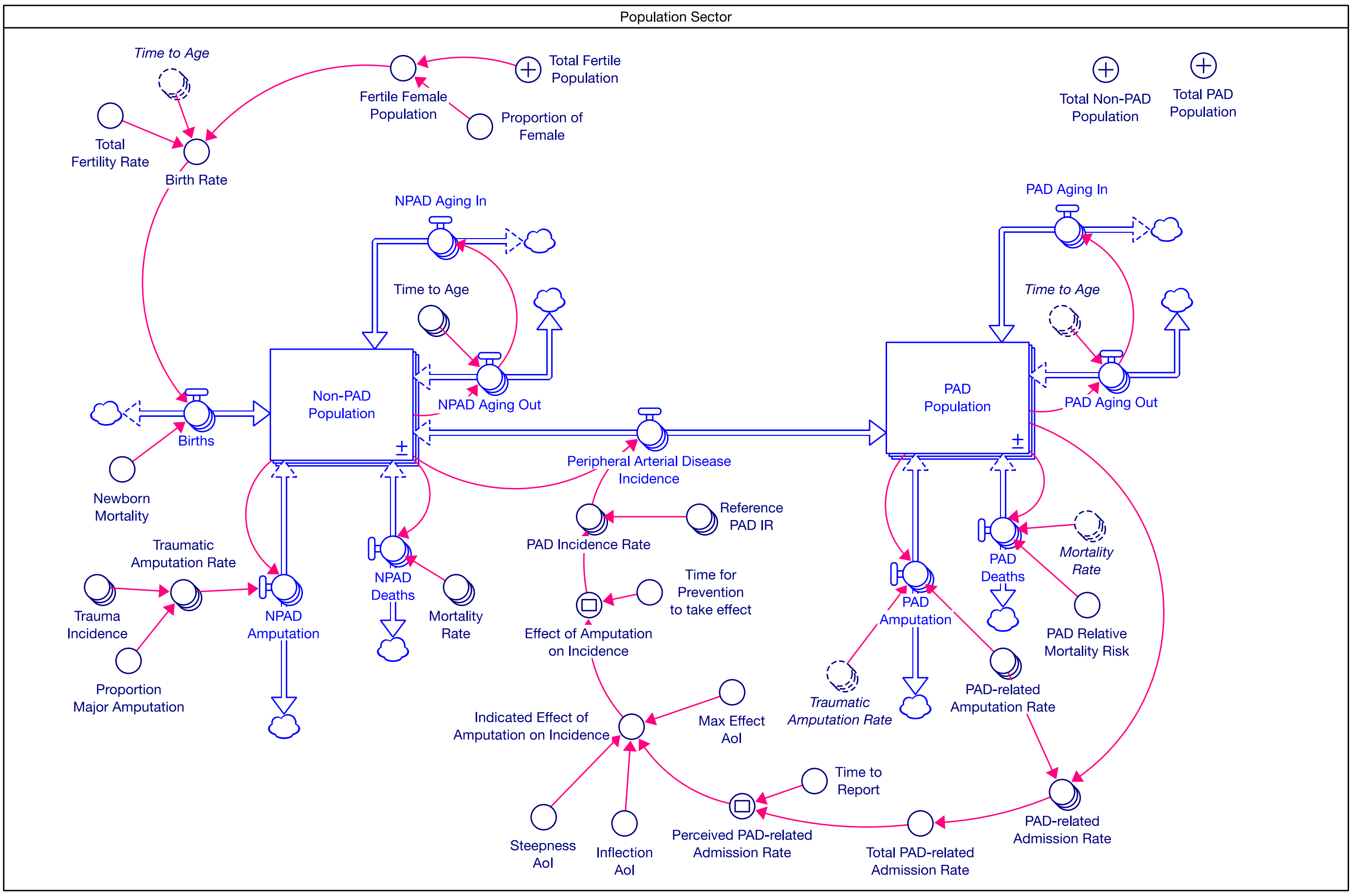

Figure S1. Stock and flow structure of Population Sector

Table S1. Documentation for Population Sector.

Population Sector

Birth_Rate = Fertile_Female_Population*Total_Fertility_Rate/Time_to_Age["15_to_44"]

UNITS: People/month

DOCUMENT: This variable dynamically calculates the birth rate at any point in time, representing the births per month. It is calculated by multiplying the total fertile female population by the total fertility rate, and then divided by the fertile duration.

Effect_of_Amputation_on_Incidence = SMTH3(Indicated_Effect_of_Amputation_on_Incidence, Time_for_Prevention_to_take_effect) {DELAY CONVERTER}

UNITS: dmnl

DOCUMENT: This variable represented the delayed effect of PAD-related amputation rates on PAD incidence rate. It is modelled with a third-order information delay with the assumption that it goes through several delay processes, which includes prevention activity-planning and implementation.

Fertile_Female_Population = Total_Fertile_Population*Proportion_of_Female

UNITS: people

DOCUMENT: This variable dynamically calculates the total number of females in the United Kingdom who are of fertile age. It simply multiplies the proportion of females with the total fertile age population.

Indicated_Effect_of_Amputation_on_Incidence = Max_Effect_AoI/(1+ EXP(Steepness_AoI*("Perceived_PAD-related_Admission_Rate"//INIT("Perceived_PAD-related_Admission_Rate")-Inflection_AoI)))

UNITS: dmnl

DOCUMENT: This variable represents the effect of perceived PAD-related admission rate on PAD incidence rate. As the relative perceived admission rate from PAD-related amputation cases increases (current rate compared to initial), we expect pressure on the public health sector in stepping up PAD prevention activities to bring down the incidence rate.

The effect variable is analytically formulated as a inverse Sigmoid function (z-shaped). With this formulation, when the relative admission rate is 1, then the effect on incidence rate is 1 – meaning that it will be at its reference value. As the relative admission rate increases towards 2, indicating a prevention pressure, the effect decreases decreasingly towards 0. Whereas as relative admission decreases towards 0 (situation easing), the effect increases decreasingly towards a maximum effect of 2. The assumption here is that if there is no prevention pressure, then the public health sector is likely to reallocate resources to other diseases.

Inflection_AoI = 1

UNITS: dmnl

DOCUMENT: This parameter sets the inflection point of the Sigmoid curve for the Indicated Effect of Amputation on Incidence. The inflection point is set at (1,1) where relative value at 1 returns the reference PAD incidence rate.

Max_Effect_AoI = 2

UNITS: dmnl

DOCUMENT: This parameter sets the maximum effect at 2 for the Indicated Effect of Amputation on Incidence. It is assumed that the fractional PAD incidence rate would at worse double, and best reduce towards 0.

Mortality_Rate[Under_15] = 0.0000095520833333
Mortality_Rate["15_to_44"] = 0.00006014375
Mortality_Rate["45_to_59"] = 0.00029127125
Mortality_Rate["60_to_79"] = 0.001591618
Mortality_Rate[Above_80] = 0.0163792869166667

UNITS: dmnl/month

DOCUMENT: This parameter represents the average mortality rates by age groups in the United Kingdom based on historical time-series data retrieved from population census [1]. The rates have been adjusted from years to months.

Newborn_Mortality = 0.0033
UNITS: dmnl
DOCUMENT: This parameter represents the average mortality of infants in the United Kingdom based on historical time-series data retrieved from population census [1].

"Non-PAD_Population"[Age_Cohort](t) = "Non-PAD_Population"[Age_Cohort](t - dt) + (Births[Age_Cohort] + NPAD_Migration[Age_Cohort] + NPAD_Aging_In[Age_Cohort] - NPAD_Aging_Out[Age_Cohort] - NPAD_Deaths[Age_Cohort] - NPAD_Amputation[Age_Cohort] - Peripheral_Arterial_Disease_Incidence[Age_Cohort]) * dt
INIT "Non-PAD_Population"[Under_15] = 12700000
INIT "Non-PAD_Population"["15_to_44"] = 24000000
INIT "Non-PAD_Population"["45_to_59"] = 10700000
INIT "Non-PAD_Population"["60_to_79"] = 9520000
INIT "Non-PAD_Population"[Above_80] = 2420000
UNITS: People
DOCUMENT: This stock represents the total non-amputee population who do not have peripheral arterial disease. It is accumulated by the inflow Births and depleted by the outflows Deaths, PAD Incidence, and Amputation. The stock is arrayed by age cohorts. The initial value of the stock is set close to the long-term equilibrium value of the stock.

INFLOWS:
Births[Under_15] = Birth_Rate*(1-Newborn_Mortality)
Births["15_to_44"] = 0
Births["45_to_59"] = 0
Births["60_to_79"] = 0
Births[Above_80] = 0
UNITS: People/month
DOCUMENT: This inflow represents the number of successful births in the UK per month, and it accumulates the Non-PAD Population stock. The successful birth rate is determined by the total birth rates multiplied by the fraction of newborns that do not die, or rather survive.

NPAD_Aging_In[Under_15] = 0
NPAD_Aging_In["15_to_44"] = NPAD_Aging_Out[Under_15]
NPAD_Aging_In["45_to_59"] = NPAD_Aging_Out["15_to_44"]
NPAD_Aging_In["60_to_79"] = NPAD_Aging_Out["45_to_59"]
NPAD_Aging_In[Above_80] = NPAD_Aging_Out["60_to_79"]
UNITS: People/month
DOCUMENT: This inflow takes those who have aged out of the previous cohort and allows re-entry into the next appropriate age group.

OUTFLOWS:
NPAD_Aging_Out[Age_Cohort] = "Non-PAD_Population"//Time_to_Age
UNITS: People/month
DOCUMENT: This outflow represents the rate at which people age out of their respective cohort groups. This rate is determined by a simple first order adjustment, where the total number of people in the population stock is divided by the residence time.

NPAD_Deaths[Age_Cohort] = "Non-PAD_Population"*Mortality_Rate
UNITS: People/month
DOCUMENT: This outflow represents the deaths for non-peripheral arterial disease population, that depletes the population stock. The rate is determined by the mortality rate multiplied by the respective Non-PAD Population stock value.

NPAD_Amputation[Age_Cohort] = "Non-PAD_Population"*Traumatic_Amputation_Rate
UNITS: People/month
DOCUMENT: This outflow represents the amputation rates for non-peripheral arterial disease population, that depletes the population stock. The rate is determined solely by the traumatic amputation rate multiplied by the respective Non-PAD Population stock.

Peripheral_Arterial_Disease_Incidence[Age_Cohort] = "Non-PAD_Population"*PAD_Incidence_Rate
UNITS: People/month
DOCUMENT: This biflow represents the incidence rate for peripheral arterial disease (PAD); it depletes the non-PAD population stock and simultaneously accumulates the PAD population stock. The rate is determined by fractional PAD incidence rate multiplied with the Non-PAD population stock.

PAD_Incidence_Rate[Age_Cohort] = Reference_PAD_IR*Effect_of_Amputation_on_Incidence
UNITS: dmnl/month
DOCUMENT: This variable represents the monthly fractional incidence rate of peripheral arterial disease in the United Kingdom. It is determined by the reference fractional rate adjusted by the effect from PAD-related amputation admission rate.

PAD_Population[Age_Cohort](t) = PAD_Population[Age_Cohort](t - dt) + (Peripheral_Arterial_Disease_Incidence[Age_Cohort] + PAD_Migration[Age_Cohort] + PAD_Aging_In[Age_Cohort] - PAD_Amputation[Age_Cohort] - PAD_Deaths[Age_Cohort] - PAD_Aging_Out[Age_Cohort]) * dt
INIT PAD_Population[Under_15] = 0
INIT PAD_Population["15_to_44"] = 0
INIT PAD_Population["45_to_59"] = 305000
INIT PAD_Population["60_to_79"] = 1130000
INIT PAD_Population[Above_80] = 227000
UNITS: People
DOCUMENT: This stock represents the total non-amputee population with peripheral arterial and are at greater risk for amputation. It is accumulated by the inflow PAD Incidence and depleted by the outflows Deaths and Amputation. The stock is arrayed by age cohorts. The initial value of the stock is set close to the long-term equilibrium value of the stock.

INFLOWS:
Peripheral_Arterial_Disease_Incidence[Age_Cohort] = "Non-PAD_Population"*PAD_Incidence_Rate
UNITS: People/month
DOCUMENT: This biflow represents the incidence rate for peripheral arterial disease (PAD); it depletes the non-PAD population stock and simultaneously accumulates the PAD population stock. The rate is determined by fractional PAD incidence rate multiplied with the Non-PAD population stock.

PAD_Aging_In[Under_15] = 0
PAD_Aging_In["15_to_44"] = 0
PAD_Aging_In["45_to_59"] = 0
PAD_Aging_In["60_to_79"] = PAD_Aging_Out["45_to_59"]
PAD_Aging_In[Above_80] = PAD_Aging_Out["60_to_79"]
UNITS: People/month
DOCUMENT: This inflow takes those who have aged out of the previous cohort and allows re-entry into the next appropriate age group.

OUTFLOWS:

PAD_Amputation[Age_Cohort] = PAD_Population*(Traumatic_Amputation_Rate+"PAD-related_Amputation_Rate")

UNITS: People/month

DOCUMENT: This outflow represents the amputation rates for peripheral arterial disease population, that depletes the population stock. The rate is determined by both the traumatic amputation rate and PAD-related amputation rate multiplied by the respective Non-PAD Population stock.

PAD_Deaths[Age_Cohort] = PAD_Population*Mortality_Rate*PAD_Relative_Mortality_Risk

UNITS: People/month

DOCUMENT: This outflow represents the deaths for peripheral arterial disease population, that depletes the population stock. The rate is determined by the the mortality rate multiplied by the respective PAD Population stock value, adjusted by a multiplier to take into account the relative mortality rate as a result of PAD.

PAD_Aging_Out[Age_Cohort] = PAD_Population//Time_to_Age

UNITS: People/month

DOCUMENT: This outflow represents the rate at which people age out of their respective cohort groups. This rate is determined by a simple first order adjustment, where the the total number of people in the population stock is divided by the residence time.

PAD_Relative_Mortality_Risk = 1.86

UNITS: dmnl

DOCUMENT: This parameter represents the relative risk of death from all causes, or hazard ratio of persons diagnosed with peripheral arterial disease as compared to the rest of the population. Based on two separate studies, the average relative mortality risk was ascertained to be 1.86 across all stages of PAD [2,3].

"PAD-related_Admission_Rate"[Age_Cohort] = PAD_Population*"PAD-related_Amputation_Rate"

UNITS: People/month

DOCUMENT: This variable dynamically calculates the PAD-related amputation admissions per month without taking into account traumatic injuries for each age cohort. It is calculated by multiplying the PAD Population with the fractional amputation rate.

"PAD-related_Amputation_Rate"[Under_15] = 0
"PAD-related_Amputation_Rate"["15_to_44"] = 0
"PAD-related_Amputation_Rate"["45_to_59"] = 0.000345
"PAD-related_Amputation_Rate"["60_to_79"] = 0.000231666666666667
"PAD-related_Amputation_Rate"[Above_80] = 0.000150833333333333

UNITS: dmnl/month

DOCUMENT: This parameter represents the major lower limb amputation rate for patients with peripheral arterial disease. This number was calculated from a composite data set constructed from the UK's National Vascular Registry annual reports. It was calculated by dividing the estimated average (data points from year 2015 to 2020) PAD-related amputations for each age cohort [4–10] with a reference number of people with PAD in each group [11].

"Perceived_PAD-related_Admission_Rate" = SMTH3("Total_PAD-related_Admission_Rate", Time_to_Report, "Total_PAD-related_Admission_Rate") {DELAY CONVERTER}

UNITS: People/month

DOCUMENT: This variable represented the general perception of PAD-related admission rate. It is modelled with a third-order information delay with the assumption that it goes through several delay processes, which includes data collection, reporting, and dissemination.

Proportion_Major_Amputation = 0.1
UNITS: dmnl
DOCUMENT: This parameter represents the proportion of lower limb amputation that are of major (above-ankle). The parameter was calibrated to 10% in order to attain an approximate proportion of traumatic amputation cases to 25% of all major lower limb amputations. This estimate was provided by expert opinion from ProsFit Technologies.

Proportion_of_Female = 0.584
UNITS: dmnl
DOCUMENT: This parameter represents the proportion of females in the UK population [12].

Reference_PAD_IR[Under_15] = 0
Reference_PAD_IR["15_to_44"] = 0
Reference_PAD_IR["45_to_59"] = 0.000194994946609834
Reference_PAD_IR["60_to_79"] = 0.000712829236872492
Reference_PAD_IR[Above_80] = 0.000816754206697227
UNITS: dmnl/month
DOCUMENT: This parameter is the reference peripheral arterial disease (PAD) fractional incidence rate for each age cohort in year 2010. It is calculated by taking the incidence estimate as a fraction of the prevalence estimate, divided by 12 months. The data was obtained from Global Burden of Disease Study filtered by cause "peripheral artery disease" [11].

Steepness_AoI = 2
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Indicated Effect of Amputation on Incidence variable. The steepness is assumed to be 2, but can be calibrated to data if available.

Time_for_Prevention_to_take_effect = 120
UNITS: month
DOCUMENT: This parameter represents the time taken for prevention activities to be implemented before there is an effect on the incidence rate. Here, it is assumed that the delay time is 10 years.

Time_to_Age[Under_15] = 180
Time_to_Age["15_to_44"] = 348
Time_to_Age["45_to_59"] = 168
Time_to_Age["60_to_79"] = 228
Time_to_Age[Above_80] = 0
UNITS: Months
DOCUMENT: This parameter is the residence time for each age cohort. In other words, it represents the duration they will remain in the cohort before moving on to the next age cohort group. The residence time is multiplied by 12 for each value to convert the duration from years to months.

Time_to_Report = 36
UNITS: months
DOCUMENT: This parameter represents the time taken for the information to collected, reported and disseminated before reaching the wider public. Here, it is assumed that the information is updated with a three-year delay time.

Total_Fertile_Population = "Non-PAD_Population"["15_to_44"] + "Post-Op_Hospital_Care"["15_to_44"] + "Pre-Op_Hospital_Care"["15_to_44"] + "Recovery_(First_30_Days)"["15_to_44"] + SUM(Awaiting_Replacement["15_to_44",*]) + SUM(Definitive_Device["15_to_44",*]) + SUM(Eligible_for_Prosthesis["15_to_44",*]) + SUM(Full_Mobility["15_to_44",*]) + Ineligible_for_Prosthesis["15_to_44"] + SUM(Initial_Device["15_to_44",*]) + SUM(Limited_Mobility["15_to_44",*]) + SUM(Matured_Limb["15_to_44",*]) + PAD_Population["15_to_44"] {SUMMING CONVERTER}

UNITS: people

DOCUMENT: This summing converter dynamically calculates the total number of people in the age cohort 15-44 at any one point in time.

Total_Fertility_Rate = 1.756

UNITS: dmnl

DOCUMENT: This parameter represents the Total Fertility Rate, which was calibrated to hold the population in equilibrium.

"Total_Non-PAD_Population" = SUM("Non-PAD_Population"[*]) {SUMMING CONVERTER}

UNITS: people

DOCUMENT: This variable dynamically sums the various age cohorts of the non-peripheral arterial disease population.

Total_PAD_Population = SUM(PAD_Population[*]) {SUMMING CONVERTER}

UNITS: people

DOCUMENT: This variable dynamically sums the various age cohorts of the peripheral arterial disease population.

"Total_PAD-related_Admission_Rate" = SUM("PAD-related_Admission_Rate")

UNITS: People/month

DOCUMENT: This converter simply sums up the PAD-related admission rate of the age cohort groups.

Trauma_Incidence[Under_15] = 0.00000471666666666667
Trauma_Incidence["15_to_44"] = 0.00000875
Trauma_Incidence["45_to_59"] = 0.0000164166666666667
Trauma_Incidence["60_to_79"] = 0.00003775
Trauma_Incidence[Above_80] = 0.000200833333333333

UNITS: dmnl/month

DOCUMENT: This parameter represents the average estimated traumatic injury incidence rate for each age cohort. The data was obtained from Global Burden of Disease Study filtered by cause "Injuries" and "Amputation of lower limb" [11]. The estimates from year 2010 to 2019 were averaged and adjusted to a monthly rate.

Traumatic_Amputation_Rate[Age_Cohort] = Trauma_Incidence*Proportion_Major_Amputation

UNITS: dmnl/month

DOCUMENT: This variable calculates the traumatic amputation rate for major lower limb cases by multiplied the trauma incidence rate with the proportion of which that are major amputation cases.

Health Care System: Primary Care Sector

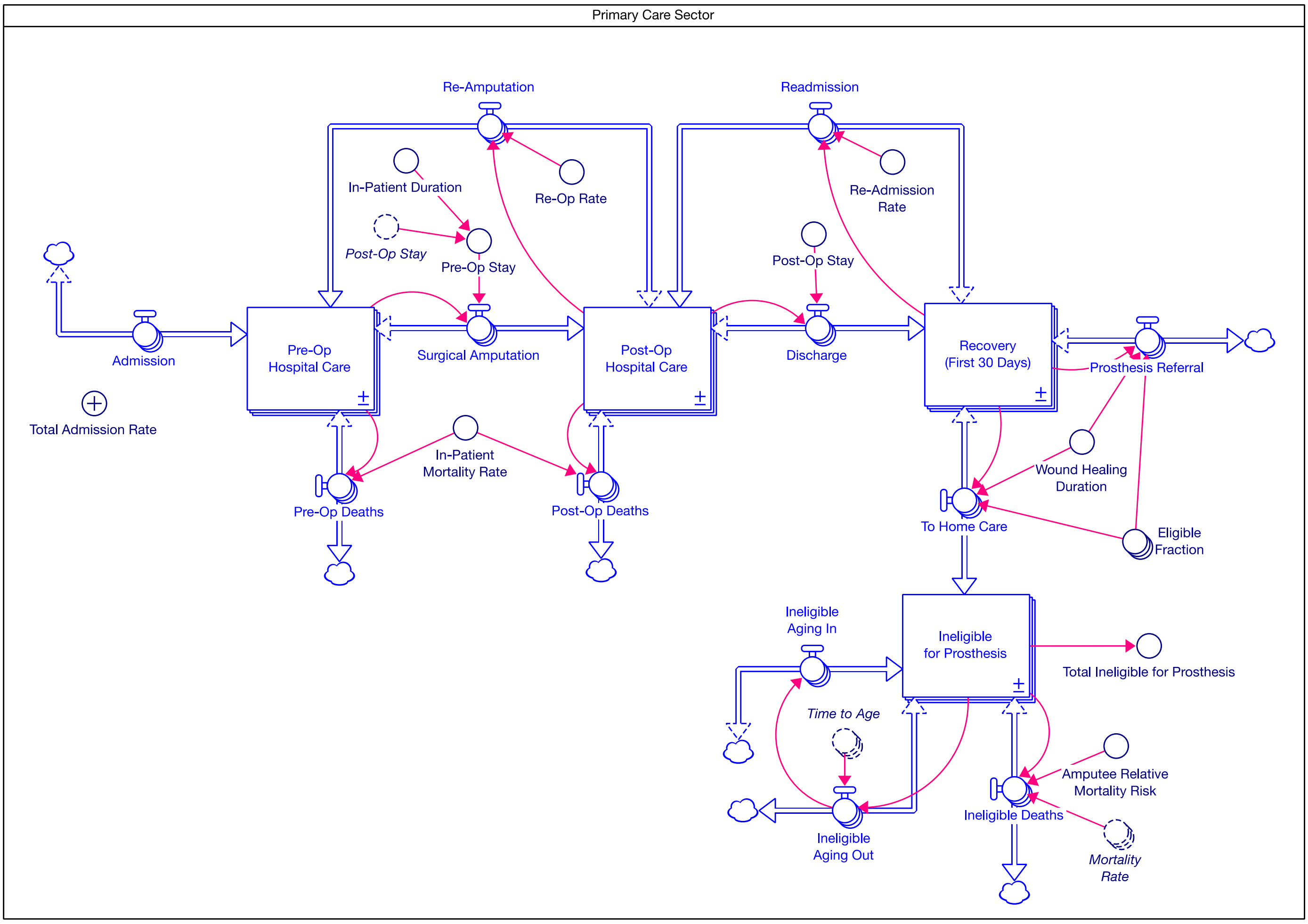

Figure S2. Stock and flow structure of primary care sector.

Table S2. Documentation for primary care sector.

Primary Care Sector

Amputee_Relative_Mortality_Risk = 3.1
UNITS: dmnl
DOCUMENT: This parameter represents the relative risk of death from all causes, or hazard ratio of persons with major lower limb amputation as compared to the rest of the population. The average relative mortality risk was ascertained to be between 2.9 and 3.3 after the third year [13].

Eligible_Fraction[Under_15] = 0.9
Eligible_Fraction["15_to_44"] = 0.9
Eligible_Fraction["45_to_59"] = 0.9
Eligible_Fraction["60_to_79"] = 0.9
Eligible_Fraction[Above_80] = 0.70
UNITS: dmnl
DOCUMENT: This parameter represents the estimated fraction of people, based on age cohort, that typically are eligible for prosthesis. The numbers were estimated from expert opinion (correspondence with ProsFit Technologies).

"In-Patient_Duration" = 21.5/30

UNITS: months

DOCUMENT: This parameter represents the total in-patient stay duration for patients undergoing surgical amputation. This number was obtained from a composite data set constructed from the UK's National Vascular Registry annual reports. The data points available from year 2017 to 2020 was averaged [6–10] and adjusted from days to months.

"In-Patient_Mortality_Rate" = 0.08

UNITS: dmnl/month

DOCUMENT: This parameter represents the in-patient mortality rate for patients undergoing surgical amputation. This number was obtained from a composite data set constructed from the UK's National Vascular Registry annual reports. The mortality rate data points available from year 2017 to 2020 was averaged [6–10]. Age-specific data was not available, and hence assumed to be the same across the board. Moreover, the mortality rate is assumed to be the same for PAD and non-PAD amputation cases.

Ineligible_for_Prosthesis[Age_Cohort](t) = Ineligible_for_Prosthesis[Age_Cohort](t - dt) + (To_Home_Care[Age_Cohort] + Ineligible_Aging_In[Age_Cohort] - Ineligible_Deaths[Age_Cohort] - Ineligible_Aging_Out[Age_Cohort]) * dt

INIT Ineligible_for_Prosthesis[Under_15] = 101

INIT Ineligible_for_Prosthesis["15_to_44"] = 825

INIT Ineligible_for_Prosthesis["45_to_59"] = 2040

INIT Ineligible_for_Prosthesis[["60_to_79"] = 4360

INIT Ineligible_for_Prosthesis[Above_80] = 863

UNITS: People

DOCUMENT: This stock represents the total amputees who are deemed ineligible for prosthesis for medical reasons. It is accumulated by the inflow To Home Care and depleted by the outflow Ineligible Deaths. The stock is arrayed by age cohorts. The initial value of the stock is set close to the long-term equilibrium value of the stock.

INFLOWS:

To_Home_Care[Age_Cohort] = ("Recovery_(First_30_Days)"/Wound_Healing_Duration)*(1-Eligible_Fraction)

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees are deemed ineligible for prosthesis and sent To Home Care permanently after recovering; it depletes the Recovery population stock and simultaneously accumulates the Ineligible for Prosthesis population stock. This rate is determined by the fraction of people who are ineligble for prosthesis multiplied by the total number of people recovering at any one point in time. This recovery rate is a first order adjustment, where the the total number of people in the Recovery stock is divided by the wound healing duration.

Ineligible_Aging_In[Under_15] = 0

Ineligible_Aging_In["15_to_44"] = Ineligible_Aging_Out[Under_15]

Ineligible_Aging_In["45_to_59"] = Ineligible_Aging_Out["15_to_44"]

Ineligible_Aging_In["60_to_79"] = Ineligible_Aging_Out["45_to_59"]

Ineligible_Aging_In[Above_80] = Ineligible_Aging_Out["60_to_79"]

UNITS: People/month

DOCUMENT: This inflow takes those who have aged out of the previous cohort and allows re-entry into the next appropriate age group.

OUTFLOWS:

Ineligible_Deaths[Age_Cohort] = Ineligible_for_Prosthesis*Mortality_Rate*Amputee_Relative_Mortality_Risk

UNITS: People/month

DOCUMENT: This outflow represents the deaths for the amputee population ineligible for prosthesis. The rate is determined by the fractional mortality rate multiplied by the respective population stock, adjusted by a multiplier to take into account the relative mortality rate as a result of amputation.

Ineligible_Aging_Out[Age_Cohort] = Ineligible_for_Prosthesis/Time_to_Age

UNITS: People/month

DOCUMENT: This outflow represents the rate at which people age out of their respective cohort groups. This rate is determined by a simple first order adjustment, where the total number of people in the population stock is divided by the residence time.

"Post-Op_Hospital_Care"[Age_Cohort](t) = "Post-Op_Hospital_Care"[Age_Cohort](t - dt) + (Surgical_Amputation[Age_Cohort] + Readmission[Age_Cohort] - Discharge[Age_Cohort] - "Post-Op_Deaths"[Age_Cohort] - "Re-Amputation"[Age_Cohort]) * dt

INIT "Post-Op_Hospital_Care"[Under_15] = 2.97

INIT "Post-Op_Hospital_Care"["15_to_44"] = 10.5

INIT "Post-Op_Hospital_Care"["45_to_59"] = 61.4

INIT "Post-Op_Hospital_Care"["60_to_79"] = 151

INIT "Post-Op_Hospital_Care"[Above_80] = 43.6

UNITS: People

DOCUMENT: This stock represents the total people in the post-operative stage of major lower limb amputation. It is accumulated by the inflows Surgical Amputation and Readmission, and depleted by the outflows Post-Op Deaths, Discharge and Re-Amputation. The stock is arrayed by age cohorts. The initial value for the stock is set close to its long-term equilibrium value.

INFLOWS:

Surgical_Amputation[Age_Cohort] = "Pre-Op_Hospital_Care"/"Pre-Op_Stay"

UNITS: People/month

DOCUMENT: This biflow represents the Surgical Amputation rate; it depletes the Pre-Op population stock and simultaneously accumulates the Post-Op population stock. This rate is determined by a simple first order adjustment, where the total number of people in the Pre-Op population stock is divided by the residence time (pre-op stay duration).

Readmission[Age_Cohort] = "Recovery_(First_30_Days)"*"Re-Admission_Rate"

UNITS: People/month

DOCUMENT: This biflow represents the readmission rate for amputees who have been discharged; it depletes the Recovery stock and simultaneously accumulates the Post-Op stock. The rate is determined by the fractional readmission rate multiplied with the Recovery stock.

OUTFLOWS:

Discharge[Age_Cohort] = ("Post-Op_Hospital_Care"/"Post-Op_Stay")

UNITS: People/month

DOCUMENT: This biflow represents the Discharge rate; it depletes the Post-Op population stock and simultaneously accumulates the Recovery population stock. This rate is determined by a simple first order adjustment, where the the total number of people in the Post-Op population stock is divided by the residence time (post-op stay duration).

"Post-Op_Deaths"[Age_Cohort] = "Post-Op_Hospital_Care"*"In-Patient_Mortality_Rate"

UNITS: People/month

DOCUMENT: This outflow represents the post-operation deaths, that depletes the population stock. The rate is determined by the in-patient mortality rate multiplied by the respective Post-Op Hospital Care stock.

"Re-Amputation"[Age_Cohort] = "Post-Op_Hospital_Care"*"Re-Op_Rate"
UNITS: People/month
DOCUMENT: This biflow represents the re-amputation rate for post-op amputees; it depletes the Post-Op population stock and simultaneously accumulates the Pre-Op population stock. The rate is determined by the fractional re-operation rate multiplied with the Post-Op population stock.

"Post-Op_Stay" = 14.5/30
UNITS: months
DOCUMENT: This parameter represents the post-operation stay duration for patients who underwent surgical amputation. This number was obtained from a composite data set constructed from the UK's National Vascular Registry annual reports. The data points available from year 2017 to 2020 was averaged [6–10] and adjusted from days to months.

"Pre-Op_Hospital_Care"[Age_Cohort](t) = "Pre-Op_Hospital_Care"[Age_Cohort](t - dt) + ("Re-Amputation"[Age_Cohort] + Admission[Age_Cohort] - Surgical_Amputation[Age_Cohort] - "Pre-Op_Deaths"[Age_Cohort]) * dt
INIT "Pre-Op_Hospital_Care"[Under_15] = 1.43
INIT "Pre-Op_Hospital_Care"["15_to_44"] = 5.02
INIT "Pre-Op_Hospital_Care"["45_to_59"] = 29.5
INIT "Pre-Op_Hospital_Care"["60_to_79"] = 72.5
INIT "Pre-Op_Hospital_Care"[Above_80] = 20.9
UNITS: People
DOCUMENT: This stock represents the total people admitted to hospital for major lower limb amputation, at the pre-operation stage. It is accumulated by the inflows Admission and Re-Amputation, and depleted by the outflows Pre-Op Deaths and Surgical Amputation. The stock is arrayed by age cohorts. The initial value for the stock is set close to its long-term equilibrium value.

INFLOWS:
"Re-Amputation"[Age_Cohort] = "Post-Op_Hospital_Care"*"Re-Op_Rate"
UNITS: People/month
DOCUMENT: This biflow represents the re-amputation rate for post-op amputees; it depletes the Post-Op population stock and simultaneously accumulates the Pre-Op population stock. The rate is determined by the fractional re-operation rate multiplied with the Post-Op population stock.

Admission[Age_Cohort] = NPAD_Amputation[Age_Cohort]+ PAD_Amputation[Age_Cohort]
UNITS: People/month
DOCUMENT: This inflow represents the number of hopital admissions per month for major lower limb amputation, and it accumulates the Pre-Op Hospital Care stock. The admission rate is simply the sum of the Non-peripheral arterial diseases amputation cases and PAD amputation cases.

OUTFLOWS:
Surgical_Amputation[Age_Cohort] = "Pre-Op_Hospital_Care"/"Pre-Op_Stay"
UNITS: People/month
DOCUMENT: This biflow represents the Surgical Amputation rate; it depletes the Pre-Op population stock and simultaneously accumulates the Post-Op population stock. This rate is determined by a simple first order adjustment, where the total number of people in the Pre-Op population stock is divided by the residence time (pre-op stay duration).

"Pre-Op_Deaths"[Age_Cohort] = "Pre-Op_Hospital_Care"*"In-Patient_Mortality_Rate"
UNITS: People/month
DOCUMENT: This outflow represents the pre-operation deaths, that depletes the population stock. The rate is determined by the in-patient mortality rate multiplied by the respective Pre-Op Hospital Care stock.

"Pre-Op_Stay" = "In-Patient_Duration"-"Post-Op_Stay"

UNITS: months

DOCUMENT: This converter calculates the pre-operation stay duration for patients undergoing surgical amputation. It is calculated by subtracting the Post-Op Stay from the total In-Patient Duration.

"Re-Admission_Rate" = 0.095

UNITS: dmnl/month

DOCUMENT: This parameter represents the fractional rate at which patients were re-admitted within the first 30 days after surgery. This number was obtained from a composite data set constructed from the UK's National Vascular Registry annual reports. The data points available from year 2017 to 2020 were averaged [6–10].

"Re-Op_Rate" = 0.09

UNITS: dmnl/month

DOCUMENT: This parameter represents the fractional rate at which post-op patients return to theatre for re-amputation arising from complications. This number was obtained from a composite data set constructed from the UK's National Vascular Registry annual reports. The data points available from year 2017 to 2020 were averaged [6–10].

"Recovery_(First_30_Days)"[Age_Cohort](t) = "Recovery_(First_30_Days)"[Age_Cohort](t - dt) + (Discharge[Age_Cohort] - Readmission[Age_Cohort] - Prosthesis_Referral[Age_Cohort] - To_Home_Care[Age_Cohort]) * dt

INIT "Recovery_(First_30_Days)"[Under_15] = 5.62

INIT "Recovery_(First_30_Days)"["15_to_44"] = 19.7

INIT "Recovery_(First_30_Days)"["45_to_59"] = 116

INIT "Recovery_(First_30_Days)"["60_to_79"] = 285

INIT "Recovery_(First_30_Days)"[Above_80] = 82.3

UNITS: People

DOCUMENT: This stock represents the total people in the first 30 days of recovery after discharge. This is the critical period where patients might experience complications as well as the wound healing duration before being assessed and referred to a prosthetist. It is accumulated by the inflow Discharge, and depleted by the outflows Readmission, Prosthesis Referral and To Home Care. The stock is arrayed by age cohorts. The initial value for the stock is set close to the long-term equilibrium value of the stock.

INFLOWS:

Discharge[Age_Cohort] = ("Post-Op_Hospital_Care"/"Post-Op_Stay")

UNITS: People/month

DOCUMENT: This biflow represents the Discharge rate; it depletes the Post-Op population stock and simultaneously accumulates the Recovery population stock. This rate is determined by a simple first order adjustment, where the total number of people in the Post-Op population stock is divided by the residence time (post-op stay duration).

OUTFLOWS:

Readmission[Age_Cohort] = "Recovery_(First_30_Days)"*"Re-Admission_Rate"

UNITS: People/month

DOCUMENT: This biflow represents the readmission rate for amputees who have been discharged; it depletes the Recovery stock and simultaneously accumulates the Post-Op stock. The rate is determined by the fractional readmission rate multiplied with the Recovery stock.

Prosthesis_Referral[Age_Cohort] = ("Recovery_(First_30_Days)"/Wound_Healing_Duration)*Eligible_Fraction

UNITS: People/month

DOCUMENT: This outflow represents the rate at which amputees are deemed eligible for prosthesis and referred to a prosthetist. It depletes the Recovery population stock. The rate is determined by the fraction of people who are eligible for prosthesis multiplied by the total number of people recovering at any one point in time. This recovery rate is a first order adjustment, where the total number of people in the Recovery stock is divided by the wound healing duration.

To_Home_Care[Age_Cohort] = ("Recovery_(First_30_Days)"/Wound_Healing_Duration)*(1-Eligible_Fraction)

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees are deemed ineligible for prosthesis and sent To Home Care permanently after recovering; it depletes the Recovery population stock and simultaneously accumulates the Ineligible for Prosthesis population stock. This rate is determined by the fraction of people who are ineligible for prosthesis multiplied by the total number of people recovering at any one point in time. This recovery rate is a first order adjustment, where the total number of people in the Recovery stock is divided by the wound healing duration.

Total_Admission_Rate = SUM(Admission[*]) {SUMMING CONVERTER}

UNITS: People/month

DOCUMENT: This summing converter totals the number of admissions irrespective of age groups at any one point in time.

Wound_Healing_Duration = 1

UNITS: month

DOCUMENT: This parameter represents the wound healing duration for patients who underwent surgical amputation. Based on the general timeline for prosthetic rehabilitation, amputees incision fully heals within the first month after surgery and receive an initial prosthetic evaluation [14].

Health Care System: Prosthetics Care Sector

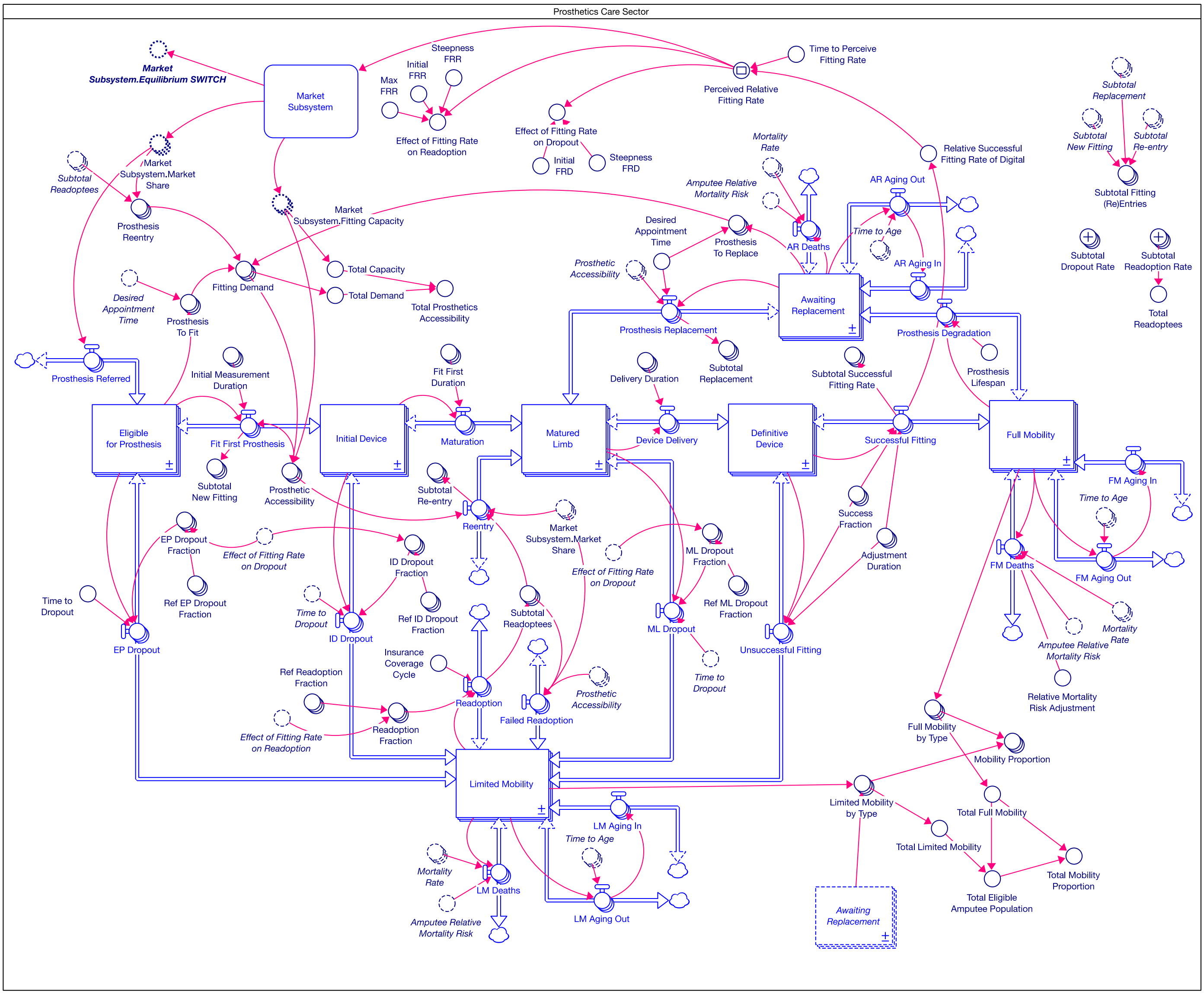

Figure S3. Stock and flow structure of prosthetics care sector.

Table S3. Documentation for prosthetics care sector

Prosthetics Care Sector
Adjustment_Duration[Prosthesis_Type] = 3 UNITS: month DOCUMENT: This parameter represents the duration for amputees to adjust to their newly fitted prosthesis. Based on the general timeline for prosthetic rehabilitation, amputees continue to undergo rehabilitation after receiving the definitive device months [14]. In the timeline, the definitive device duration is 6 months and includes both delivery and rehabilitation. Hence, subtracting the delivery duration for traditional prosthesis from this timeline, gives us around 3 months of rehabilitation period before the patient exits prosthetic care and into holistic lifelong care [14].

Awaiting_Replacement[Age_Cohort, Prosthesis_Type](t) = Awaiting_Replacement[Age_Cohort, Prosthesis_Type](t - dt) + (Prosthesis_Degradation[Age_Cohort, Prosthesis_Type] + AR_Aging_In[Age_Cohort, Prosthesis_Type] - Prosthesis_Replacement[Age_Cohort, Prosthesis_Type] - AR_Deaths[Age_Cohort, Prosthesis_Type] - AR_Aging_Out[Age_Cohort, Prosthesis_Type]) * dt

INIT Awaiting_Replacement[Age_Cohort, Digital] = 0

INIT Awaiting_Replacement[Under_15, Traditional] = 13.9

INIT Awaiting_Replacement["15_to_44", Traditional] = 76.5

INIT Awaiting_Replacement["45_to_59", Traditional] = 283

INIT Awaiting_Replacement["60_to_79", Traditional] = 709

INIT Awaiting_Replacement[Above_80, Traditional] = 124

UNITS: People

DOCUMENT: This stock represents the total amputees who are awaiting the replacement of their degraded prosthesis and are thus temporarily made immobile. It is accumulated by the inflow Prosthesis Degradation and depleted by the outflows AR Deaths and Prosthesis Replacement. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

INFLOWS:

Prosthesis_Degradation[Age_Cohort, Prosthesis_Type] = Full_Mobility/Prosthesis_Lifespan

UNITS: People/month

DOCUMENT: This biflow represents the Prosthesis Degradation rate; it depletes the Full Mobility stock and simultaneously accumulates the Awaiting Replacement stock. This rate is determined by a simple first order adjustment, where the total number of people in the Full Mobility stock is divided by the residence time (prosthesis lifespan).

AR_Aging_In[Under_15, Digital] = 0

AR_Aging_In[Under_15, Traditional] = 0

AR_Aging_In["15_to_44", Digital] = AR_Aging_Out[Under_15,Digital]

AR_Aging_In["15_to_44", Traditional] = AR_Aging_Out[Under_15,Traditional]

AR_Aging_In["45_to_59", Digital] = AR_Aging_Out["15_to_44",Digital]

AR_Aging_In["45_to_59", Traditional] = AR_Aging_Out["15_to_44",Traditional]

AR_Aging_In["60_to_79", Digital] = AR_Aging_Out["45_to_59",Digital]

AR_Aging_In["60_to_79", Traditional] = AR_Aging_Out["45_to_59",Traditional]

AR_Aging_In[Above_80, Digital] = AR_Aging_Out["60_to_79",Digital]

AR_Aging_In[Above_80, Traditional] = AR_Aging_Out["60_to_79",Traditional]

UNITS: People/month

DOCUMENT: This inflow takes those who have aged out of the previous cohort and allows re-entry into the next appropriate age group.

OUTFLOWS:

Prosthesis_Replacement[Age_Cohort, Prosthesis_Type] = Prosthetic_Accessibility[Prosthesis_Type]*Awaiting_Replacement/Desired_Appointment_Time

UNITS: People/month

DOCUMENT: This biflow represents the Prosthesis Replacement rate; it depletes the Awaiting Replacement stock and simultaneously accumulates the Matured Limb stock. The rate is determined by the fraction of people who have access to a prosthetist multiplied by the total number of people requiring a replacement at any one point in time.

AR_Deaths[Age_Cohort, Prosthesis_Type] = Awaiting_Replacement*Mortality_Rate[Age_Cohort]*Amputee_Relative_Mortality_Risk

UNITS: People/month

DOCUMENT: This outflow represents the deaths for the amputee population awaiting the replacement of their degraded prosthesis. The rate is determined by the fractional mortality rate multiplied by the respective population stock, adjusted by a multiplier to take into account the relative mortality rate as a result of amputation.

AR_Aging_Out[Age_Cohort, Prosthesis_Type] = Awaiting_Replacement//Time_to_Age[Age_Cohort]

UNITS: People/month

DOCUMENT: This outflow represents the rate at which people age out of their respective cohort groups. This rate is determined by a simple first order adjustment, where the total number of people in the population stock is divided by the residence time.

Definitive_Device[Age_Cohort, Prosthesis_Type](t) = Definitive_Device[Age_Cohort, Prosthesis_Type](t - dt) + (Device_Delivery[Age_Cohort, Prosthesis_Type] - Successful_Fitting[Age_Cohort, Prosthesis_Type] - Unsuccessful_Fitting[Age_Cohort, Prosthesis_Type]) * dt

INIT Definitive_Device[Age_Cohort, Digital] = 0

INIT Definitive_Device[Under_15, Traditional] = 12.2

INIT Definitive_Device["15_to_44", Traditional] = 58.5

INIT Definitive_Device["45_to_59", Traditional] = 251

INIT Definitive_Device["60_to_79", Traditional] = 613

INIT Definitive_Device[Above_80, Traditional] = 120

UNITS: People

DOCUMENT: This stock represents the total amputees who has received a definitive device and are adjusting to the new prosthesis with rehabilitation. It is accumulated by the inflow Device Delivery and depleted by the outflows Successful Fitting and Unsuccessful Fitting. The stock is arrayed by age cohorts and prosthesis type. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

INFLOWS:

Device_Delivery[Age_Cohort, Prosthesis_Type] = Matured_Limb/Delivery_Duration[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees, whose limbs have matured, receive a definitive prosthesis device. It depletes the Matured Limb stock and simultaneously accumulates the Definitive Device stock. The rate is determined by a first order material delay, where the total number of people in the Matured Limb stock is divided by the Delivery Duration.

OUTFLOWS:

Successful_Fitting[Age_Cohort, Prosthesis_Type] = (Definitive_Device/Adjustment_Duration[Prosthesis_Type])*Success_Fraction[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees are successfully fitted with a prosthesis. It depletes the Definitive Device stock and simultaneously accumulates the Full Mobility stock. The rate is determined by the product of the success fraction and the total number of people who have adjusted to their new prosthesis device at any one point in time. This adjustment rate is a first order adjustment, where the total number of people in the Definitive Device stock is divided by the adjustment duration.

Unsuccessful_Fitting[Age_Cohort, Prosthesis_Type] = (Definitive_Device/Adjustment_Duration[Prosthesis_Type])*(1-Success_Fraction[Prosthesis_Type])

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees are unsuccessfully fitted with a prosthesis, thus leading to abandonment of the definitive device. It depletes the Definitive Device stock and simultaneously accumulates the Limited Mobility stock. The rate is determined by the product of the total number of people who have adjusted to their new prosthesis device at any one point in time and the inverse of the success fraction. The adjustment rate is a first order adjustment, where the total number of people in the Definitive Device stock is divided by the adjustment duration.

Delivery_Duration[Digital] = 0.25
Delivery_Duration[Traditional] = 1.5

UNITS: month

DOCUMENT: This parameter represents the delivery duration for the definitive device to be manufactured and fitted on the amputees. Based on expert opinion from prosthetists, this delivery delay is estimated to be 1.5 months for traditional plaster-cast socket devices and a much shorter duration of 0.25 months for a 3D-printed digital device (correspondence with ProsFit).

Desired_Appointment_Time = 1

UNITS: month

DOCUMENT: This parameter represents the desired time for an individual to make an appointment with a prosthetist in order to get fitted for a prosthesis or replace their degraded prosthesis. Here, the assumption is that people would want to get an appointment within the first month.

Effect_of_Fitting_Rate_on_Dropout = Initial_FRD*(EXP(-Perceived_Relative_Fitting_Rate/Steepness_FRD))

UNITS: dmnl

DOCUMENT: This variable represents the effect of perceived Relative Fitting Rate on the reference Dropout Fraction. As the relative perceived successful fitting rate of the digital prosthesis increases, we expect more word-of-mouth dissemination of information. The assumption here is that as digital fittings experience more success, people are less likely to dropout since they might be motivated to see through the process and experience a similar success as others.

The effect variable is analytically formulated as an exponential decay from 1 to 0. In other words, the effect decreases decreasingly from an initial value of 1 to 0, with a certain steepness. Hence, when the relative rate is 0, then the dropout fraction will be at its normal or reference value. As the relative rate starts increasing, the dropout fraction will exponentially decay from its reference value towards 0.

Effect_of_Fitting_Rate_on_Readoption = MIN(Max_FRR, Initial_FRR*(EXP(Perceived_Relative_Fitting_Rate/Steepness_FRR)))

UNITS: dmnl

DOCUMENT: This variable represents the effect of perceived Relative Fitting Rate on the reference Readoption Fraction. As the relative perceived successful fitting rate of the digital prosthesis increases, we expect more word-of-mouth dissemination of information. The assumption here is that as digital fittings experience more success, people are more likely to readopt digital prosthesis since they might be motivated to try the digital process and experience a similar success as others.

The effect variable is analytically formulated as an exponential growth from 1 to a maximum effect of 2. In other words, the effect increases increasingly from an initial value of 1 to 2, with a certain steepness. Hence, when the relative rate is 0, then the readoption fraction will be at its normal or reference value. As the relative rate starts increasing, the dropout fraction will exponentially increase from its reference value towards a maximum of twice its value.

Eligible_for_Prosthesis[Age_Cohort, Prosthesis_Type](t) = Eligible_for_Prosthesis[Age_Cohort, Prosthesis_Type](t - dt) + (Prosthesis_Referred[Age_Cohort, Prosthesis_Type] - Fit_First_Prosthesis[Age_Cohort, Prosthesis_Type] - EP_Dropout[Age_Cohort, Prosthesis_Type]) * dt

INIT Eligible_for_Prosthesis[Age_Cohort, Digital] = 0

INIT Eligible_for_Prosthesis[Under_15, Traditional] = 15.1

INIT Eligible_for_Prosthesis["15_to_44", Traditional] = 53.2

INIT Eligible_for_Prosthesis["45_to_59", Traditional] = 312

INIT Eligible_for_Prosthesis["60_to_79", Traditional] = 768

INIT Eligible_for_Prosthesis [Above_80, Traditional] = 172

UNITS: People

DOCUMENT: This stock represents the total amputees who are eligible for a prosthesis and have entered the prosthetic care continuum. It is accumulated by the inflow Prosthesis Referred and depleted by the outflows Fit First Prosthesis and EP Dropout. The stock is arrayed by age cohorts and prosthesis type. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

INFLOWS:

Prosthesis_Referred[Under_15, Digital] = Prosthesis_Referral[Under_15]*Market_Subsystem.Market_Share[Digital]

Prosthesis_Referred[Under_15, Traditional] = Prosthesis_Referral[Under_15]*Market_Subsystem.Market_Share[Traditional]

Prosthesis_Referred["15_to_44", Digital] = Prosthesis_Referral["15_to_44"]*Market_Subsystem.Market_Share[Digital]

Prosthesis_Referred["15_to_44", Traditional] = Prosthesis_Referral["15_to_44"]*Market_Subsystem.Market_Share[Traditional]

Prosthesis_Referred["45_to_59", Digital] = Prosthesis_Referral["45_to_59"]*Market_Subsystem.Market_Share[Digital]

Prosthesis_Referred["45_to_59", Traditional] = Prosthesis_Referral["45_to_59"]*Market_Subsystem.Market_Share[Traditional]

Prosthesis_Referred["60_to_79", Digital] = Prosthesis_Referral["60_to_79"]*Market_Subsystem.Market_Share[Digital]

Prosthesis_Referred["60_to_79", Traditional] = Prosthesis_Referral["60_to_79"]*Market_Subsystem.Market_Share[Traditional]

Prosthesis_Referred[Above_80, Digital] = Prosthesis_Referral[Above_80]*Market_Subsystem.Market_Share[Digital]

Prosthesis_Referred[Above_80, Traditional] = Prosthesis_Referral[Above_80]*Market_Subsystem.Market_Share[Traditional]

UNITS: People/month

DOCUMENT: This inflow represents the number of amputees who are deemed eligible and given a referral to prosthetic care, and it accumulates the Eligible for Prosthesis stock. The referred rate is simply the prosthesis referral rate that is redistributed to the respective prosthesis array dimension based on the market share of each prosthesis type. The market share is taken as the probability that an amputee will be referred to either a traditional or digital prosthetist.

OUTFLOWS:

Fit_First_Prosthesis[Age_Cohort, Prosthesis_Type] = Eligible_for_Prosthesis*Prosthetic_Accessibility[Prosthesis_Type]/Initial_Measurement_Duration[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees get measured and fitted with an initial fit first device. It depletes the Eligible for Prosthesis stock and simultaneously accumulates the Initial Device stock. The rate is determined by the product of the total number of people who would like to be fitted with an initial device at any one point in time and the prosthetic accessibility fraction. This initial measurement rate is a first order material delay, where the total number of people in the Eligible for Prosthesis stock is divided by the Initial Measurement Duration.

EP_Dropout[Age_Cohort, Prosthesis_Type] = Eligible_for_Prosthesis*EP_Dropout_Fraction[Prosthesis_Type]/Time_to_Dropout

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees who eligible for prosthesis dropout before the start of the fitting process. It depletes the Eligible for Prosthesis stock and simultaneously accumulates the Limited Mobility stock. The rate is simply a fraction of the total number of people in the Eligible for Prosthesis stock over a certain decision time to dropout.

EP_Dropout_Fraction[Digital] = Ref_EP_Dropout_Fraction[Digital]*Effect_of_Fitting_Rate_on_Dropout
EP_Dropout_Fraction[Traditional] = Ref_EP_Dropout_Fraction[Traditional]

UNITS: dmnl

DOCUMENT: This variable represents the fraction of people that on average decides to dropout from the prosthetic fitting process from the get-go, even before being fitted with an initial device. It is determined by the reference fraction adjusted by the effect from Perceived Relative Fitting Rate.

Fit_First_Duration[Prosthesis_Type] = 4

UNITS: month

DOCUMENT: This parameter represents the fit first duration for amputees. Based on the general timeline for prosthetic rehabilitation, amputees undergo gait training with an initial device for about 2 months and an additional 2 months while awaiting for the limb to mature and stabilize in volume [14].

Fitting_Demand[Prosthesis_Type] = Prosthesis_To_Fit+Prosthesis_Reentry+Prosthesis_To_Replace

UNITS: People/month

DOCUMENT: This variable dynamically calculates the total demand for prosthesis fitting at any one point in time. It is simply the sum of the desired prosthesis to fit for new amputees, the desired prosthesis for rentrants, and the desired prosthesis for amputees who need to replace their device.

Full_Mobility[Age_Cohort, Prosthesis_Type](t) = Full_Mobility[Age_Cohort, Prosthesis_Type](t - dt) + (FM_Aging_In[Age_Cohort, Prosthesis_Type] + Successful_Fitting[Age_Cohort, Prosthesis_Type] - Prosthesis_Degradation[Age_Cohort, Prosthesis_Type] - FM_Deaths[Age_Cohort, Prosthesis_Type] - FM_Aging_Out[Age_Cohort, Prosthesis_Type]) * dt

INIT Full_Mobility[Age_Cohort, Digital] = 0
INIT Full_Mobility[Under_15, Traditional] = 61.2
INIT Full_Mobility["15_to_44", Traditional] = 328
INIT Full_Mobility["45_to_59", Traditional] = 1250
INIT Full_Mobility[60_to_79", Traditional] = 3170
INIT Full_Mobility[Above_80, Traditional] = 638

UNITS: People

DOCUMENT: This stock represents the total amputees who are successfully fitted with a prosthesis and are thus fully mobile. It is accumulated by the inflow Successful Fitting and depleted by the outflows FM Deaths and Prosthesis Degradation. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

Full_Mobility_by_Type[Digital] = SUM(Full_Mobility[*,Digital])
Full_Mobility_by_Type[Traditional] = SUM(Full_Mobility[*, Traditional])
UNITS: People
DOCUMENT: This converter calculates the subtotals of amputees with full mobility by type of prosthesis.

ID_Dropout_Fraction[Digital] = Ref_ID_Dropout_Fraction[Digital]*Effect_of_Fitting_Rate_on_Dropout
ID_Dropout_Fraction[Traditional] = Ref_ID_Dropout_Fraction[Traditional]
UNITS: dmnl
DOCUMENT: This variable represents the fraction of people that on average decides to dropout from the Initial Device stage of the prosthetic fitting process. It is determined by the reference fraction adjusted by the effect from Perceived Relative Fitting Rate.

Initial_Device[Age_Cohort, Prosthesis_Type](t) = Initial_Device[Age_Cohort, Prosthesis_Type](t - dt) + (Fit_First_Prosthesis[Age_Cohort, Prosthesis_Type] - Maturation[Age_Cohort, Prosthesis_Type] - ID_Dropout[Age_Cohort, Prosthesis_Type]) * dt
INIT Initial_Device[Age_Cohort, Digital] = 0
INIT Initial_Device[Under_15, Traditional] = 10.1
INIT Initial_Device["15_to_44", Traditional] = 35.6
INIT Initial_Device["45_to_59", Traditional] = 209
INIT Initial_Device[60_to_79", Traditional] = 514
INIT Initial_Device[Above_80, Traditional] = 115
UNITS: People
DOCUMENT: This stock represents the total amputees who have taken the initial measurements for their device and provided with a fit first device for gait training. It is accumulated by the inflow Fit First Prosthesis and depleted by the outflows Maturation and ID Dropout. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

INFLOWS:
Fit_First_Prosthesis[Age_Cohort, Prosthesis_Type] = Eligible_for_Prosthesis*Prosthetic_Accessibility[Prosthesis_Type]/Initial_Measurement_Duration[Prosthesis_Type]
UNITS: People/month
DOCUMENT: This biflow represents the rate at which amputees get measured and fitted with an initial fit first device. It depletes the Eligible for Prosthesis stock and simultaneously accumulates the Initial Device stock. The rate is determined by the product of the total number of people who would like to be fitted with an initial device at any one point in time and the prosthetic accessibility fraction. This initial measurement rate is a first order material delay, where the total number of people in the Eligible for Prosthesis stock is divided by the Initial Measurement Duration.

OUTFLOWS:
Maturation[Age_Cohort, Prosthesis_Type] = Initial_Device/Fit_First_Duration[Prosthesis_Type]
UNITS: People/month
DOCUMENT: This biflow represents the maturation rate of amputees' limb, while they undergo rehabilitation with an initial fit first device. It depletes the Initial Device stock and simultaneously accumulates the Matured Limb stock. The rate is determined by a first order material delay, where the total number of people in the Initial Device stock is divided by the Fit First Duration.

ID_Dropout[Age_Cohort, Prosthesis_Type] = ID_Dropout_Fraction[Prosthesis_Type]*Initial_Device/Time_to_Dropout
UNITS: People/month
DOCUMENT: This biflow represents the rate at which amputees dropout from the Initial Device stage of the fitting process. It depletes the Initial Device stock and simultaneously accumulates the Limited Mobility stock. The rate is simply a fraction of the total number of people in the Initial Device stock over a certain decision time to dropout.

Initial_FRD = 1
UNITS: dmnl
DOCUMENT: This parameter sets the initial value for the effect of Fitting Rate on Dropout. Here, the initial effect is set at 1, so that the Dropout Fraction is initially set to its reference or normal value.

Initial_FRR = 1
UNITS: dmnl
DOCUMENT: This parameter sets the initial value for the effect of Fitting Rate on Readoption. Here, the initial effect is set at 1, so that the Readoption Fraction is initially set to its reference or normal value.

Initial_Measurement_Duration[Prosthesis_Type] = 0.5
UNITS: month
DOCUMENT: This parameter represents the initial measurement duration for amputee. Based on the general timeline for prosthetic rehabilitation, amputees measure for a prosthesis after the incision fully heals about 8 weeks after surgery [14]. Expert opinion suggest that this measurement duration and initial device fitting is done in about 2 weeks or half a month (correspondence with ProsFit).

Insurance_Coverage_Cycle = 36
UNITS: months
DOCUMENT: This parameter represents the average duration an amputee will take before deciding to restart the prosthesis fitting process. It is assumed that amputees would on average take 3 years for that decision since it is in line with the insurance coverage cycle.

Limited_Mobility[Age_Cohort, Prosthesis_Type](t) = Limited_Mobility[Age_Cohort, Prosthesis_Type](t - dt) + (LM_Aging_In[Age_Cohort, Prosthesis_Type] + EP_Dropout[Age_Cohort, Prosthesis_Type] + ID_Dropout[Age_Cohort, Prosthesis_Type] + Unsuccessful_Fitting[Age_Cohort, Prosthesis_Type] + ML_Dropout[Age_Cohort, Prosthesis_Type] + Failed_Readoption[Age_Cohort, Prosthesis_Type] - LM_Deaths[Age_Cohort, Prosthesis_Type] - LM_Aging_Out[Age_Cohort, Prosthesis_Type] - Readoption[Age_Cohort, Prosthesis_Type]) * dt
INIT Limited_Mobility[Age_Cohort, Digital] = 0
INIT Limited_Mobility[Under_15, Traditional] = 831
INIT Limited_Mobility["15_to_44", Traditional] = 7030
INIT Limited_Mobility["45_to_59", Traditional] = 16900
INIT Limited_Mobility[60_to_79", Traditional] = 36300
INIT Limited_Mobility[Above_80, Traditional] = 4160
UNITS: People
DOCUMENT: This stock represents the total amputees who have dropped out of the prosthetic care continuum and thus experience limited mobility due to a lack of prosthesis. It is accumulated by the inflows Dropout Rate (various stages), Unsuccessful Fitting and Failed Readoption, and further depleted by the outflows LM Deaths and Prosthesis Re-adoption. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

Limited_Mobility_by_Type[Digital] = SUM(Limited_Mobility[*,Digital])+ SUM(Awaiting_Replacement[*, Digital])
Limited_Mobility_by_Type[Traditional] = SUM(Limited_Mobility[*,Traditional]) + SUM(Awaiting_Replacement[*, Traditional])
UNITS: People
DOCUMENT: This converter calculates the subtotals of amputees with limited mobility by type of prosthesis.

Matured_Limb[Age_Cohort, Prosthesis_Type](t) = Matured_Limb[Age_Cohort, Prosthesis_Type](t - dt) + (Maturation[Age_Cohort, Prosthesis_Type] + Reentry[Age_Cohort, Prosthesis_Type] + Prosthesis_Replacement[Age_Cohort, Prosthesis_Type] - Device_Delivery[Age_Cohort, Prosthesis_Type] - ML_Dropout[Age_Cohort, Prosthesis_Type]) * dt

INIT Matured_Limb[Age_Cohort, Digital] = 0

INIT Matured_Limb[Under_15, Traditional] = 6.12

INIT Matured_Limb["15_to_44", Traditional] = 29.2

INIT Matured_Limb ["45_to_59", Traditional] = 126

INIT Matured_Limb[60_to_79", Traditional] = 307

INIT Matured_Limb[Above_80, Traditional] = 60.1

UNITS: People

DOCUMENT: This stock represents the total amputees whose limb stump has matured and ready for a definitive device. It is accumulated by the inflows Maturation and Reentry (of amputees who have matured limbs and have decided to re-adopt a prosthesis) and further depleted by the outflows Device Delivery and ML Dropout. The stock is arrayed by age cohorts and prosthesis type. The initial value for the digital prosthesis is 0 whereas the traditional prosthesis is set close to their long-term equilibrium values.

INFLOWS:

Maturation[Age_Cohort, Prosthesis_Type] = Initial_Device/Fit_First_Duration[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This biflow represents the maturation rate of amputees' limb, while they undergo rehabilitation with an initial fit first device. It depletes the Initial Device stock and simultaneously accumulates the Matured Limb stock. The rate is determined by a first order material delay, where the total number of people in the Initial Device stock is divided by the Fit First Duration.

Reentry[Age_Cohort, Prosthesis_Type] = Subtotal_Readoptees[Age_Cohort]*Market_Subsystem.Market_Share[Prosthesis_Type]*Prosthetic_Accessibility[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This inflow represents the rate at which matured amputees without a prosthesis have successfully re-entered the prosthesis fitting process. The rate is determined by the subtotal readoptees who are redistributed to the respective prosthesis array dimension based on the market share of each prosthesis type. The market share is taken as the probability that an amputee will be referred to either a traditional or digital prosthetist. Moreover, the Prosthetic Accessibility limits this rate by taking a fraction of people who are able to successfully gain access to a prosthetist.

Prosthesis_Replacement[Age_Cohort, Prosthesis_Type] = Prosthetic_Accessibility[Prosthesis_Type]*Awaiting_Replacement/Desired_Appointment_Time

UNITS: People/month

DOCUMENT: This biflow represents the Prosthesis Replacement rate; it depletes the Awaiting Replacement stock and simultaneously accumulates the Matured Limb stock. The rate is determined by the fraction of people who have access to a prosthetist multiplied by the total number of people requiring a replacement at any one point in time.

OUTFLOWS:

Device_Delivery[Age_Cohort, Prosthesis_Type] = Matured_Limb/Delivery_Duration[Prosthesis_Type]

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees, whose limbs have matured, receive a definitive prosthesis device. It depletes the Matured Limb stock and simultaneously accumulates the Definitive Device stock. The rate is determined by a first order material delay, where the total number of people in the Matured Limb stock is divided by the Delivery Duration.

ML_Dropout[Age_Cohort, Prosthesis_Type] = ML_Dropout_Fraction[Prosthesis_Type]*Matured_Limb/Time_to_Dropout

UNITS: People/month

DOCUMENT: This biflow represents the rate at which amputees dropout from the Matured Limb stage of the fitting process. It depletes the Matured Limb stock and simultaneously accumulates the Limited Mobility stock. The rate is simply a fraction of the total number of people in the Matured Limb stock over a certain decision time to dropout.

Max_FRR = 2

UNITS: dmnl

DOCUMENT: This parameter sets the maximum effect at 2. In this case, the maximum effect was set at 2 in order to limit the readoption fraction from exceeding 1.

ML_Dropout_Fraction[Digital] = Ref_ML_Dropout_Fraction[Digital]*Effect_of_Fitting_Rate_on_Dropout
ML_Dropout_Fraction[Traditional] = Ref_ML_Dropout_Fraction[Traditional]

UNITS: dmnl

DOCUMENT: This variable represents the fraction of people that on average decides to dropout from the Matured Limb stage of the prosthetic fitting process. It is determined by the reference fraction adjusted by the effect from Perceived Relative Fitting Rate.

Mobility_Proportion[Prosthesis_Type] = Full_Mobility_by_Type//(Full_Mobility_by_Type+Limited_Mobility_by_Type)

UNITS: dmnl

DOCUMENT: This converter calculates the proportion of amputees who are fully mobile (by prosthesis type) as a fraction of the total amputee population who are deemed eligible for prosthesis. Note that it excludes those medically ineligible for prosthesis from the total amputee population.

Perceived_Relative_Fitting_Rate = SMTH3(Relative_Successful_Fitting_Rate_of_Digital, Time_to_Perceive_Fitting_Rate, 0) {DELAY CONVERTER}

UNITS: dmnl

DOCUMENT: This variable represented the general perception of the information about the relative successful fittings of the digital and traditional prosthesis type. It is modelled with a third-order information delay with the assumption that it goes through several delay processes, which includes data collection, reporting, and word of mouth dissemination.

Prosthesis_Lifespan = 36

UNITS: months

DOCUMENT: This parameter represents the average lifespan of a prosthesis before it degrades and requires a complete replacement. On average, each device has a 3-year lifespan [14,15].

Prosthesis_Reentry[Digital] = SUM(Subtotal_Readoptees)*Market_Subsystem.Market_Share[Digital]
Prosthesis_Reentry[Traditional] = SUM(Subtotal_Readoptees)*Market_Subsystem.Market_Share[Traditional]

UNITS: People/month

DOCUMENT: This variable represents the desired rate at which amputees would like to renter the prosthetic care continuum. Here, the aggregated subtotal readoptees are redistributed into the prosthesis type array dimension based on the respective market share. The market share is taken as the probability that an amputee will choose either a traditional or digital prosthetist.

Prosthesis_To_Fit[Digital] = SUM(Eligible_for_Prosthesis[*,Digital])/Desired_Appointment_Time
Prosthesis_To_Fit[Traditional] = SUM(Eligible_for_Prosthesis[*,Traditional])/Desired_Appointment_Time
UNITS: People/month
DOCUMENT: This variable represents the desired rate at which new prostheses are to be fitted. In other words, the number of people per month who would like to start the prosthesis fitting process. This rate is a first order adjustment, where the total number of people Eligible for Prosthesis is divided by the Desired Appointment Time for meeting a prosthetist.

Prosthesis_To_Replace[Digital] = SUM(Awaiting_Replacement[*,Digital])/Desired_Appointment_Time
Prosthesis_To_Replace[Traditional] = SUM(Awaiting_Replacement[*,Traditional])/Desired_Appointment_Time
UNITS: People/month
DOCUMENT: This variable represents the desired rate at which prostheses are to be replaced. In other words, the number of people per month who would like a replacement. This rate is a first order adjustment, where the total number of people Awaiting Replacement is divided by the Desired Appointment Time for meeting a prosthetist.

Prosthetic_Accessibility[Prosthesis_Type] = MIN(1, Market_Subsystem.Fitting_Capacity//Fitting_Demand)
UNITS: dmnl
DOCUMENT: This variable represents the prosthetic accessibility for amputees desiring to be fitted with a new prosthesis. It refers to the ability of the existing fitting capacity to meet the demand. Hence, when fitting capacity is equal to fitting demand, the accessibility is 1, meaning 100% of all desired fittings can be accommodated. When the fraction is less than 1, it means that existing capacity can only meet a fraction of the demand. The equation includes a MIN function to limit this value from going above 1. So long as there is more capacity than demand, then prosthetists will still be able to meet 100% of all demand. Accessibility is conceptualized as a function of demand and capacity but does not take into account proximity. It is assumed that in the UK, all amputees have access to prosthetic healthcare in terms of physical location.

Readoption_Fraction[Prosthesis_Type] = Effect_of_Fitting_Rate_on_Readoption*Ref_Readoption_Fraction
UNITS: dmnl
DOCUMENT: This variable represents the fraction of people, who have previously abandoned a prosthesis, that on average decides to readopt it. It is determined by the reference fraction adjusted by the effect from Perceived Relative Fitting Rate.

Ref_EP_Dropout_Fraction[Prosthesis_Type] = 0.1
UNITS: dmnl
DOCUMENT: This parameter represents the typical or normal fraction of people that on average decides to dropout from the prosthetic fitting process from the get-go, even before being fitted with an initial device. The reference value was estimated by prosthetists in the field based on their experience (correspondence with ProsFit Technologies).

Ref_ID_Dropout_Fraction[Prosthesis_Type] = 0.1
UNITS: dmnl
DOCUMENT: This parameter represents the typical or normal fraction of people that on average decides to dropout from the Initial Device stage of the prosthetic fitting process. The reference value was estimated by prosthetists in the field based on their experience (correspondence with ProsFit Technologies).

Ref_ML_Dropout_Fraction[Prosthesis_Type] = 0.1
UNITS: dmnl
DOCUMENT: This parameter represents the typical or normal fraction of people that on average decides to dropout from the Matured Limb stage of the prosthetic fitting process. The reference value was estimated by prosthetists in the field based on their experience (correspondence with ProsFit Technologies).

Ref_Readoption_Fraction[Prosthesis_Type] = 0.2
UNITS: dmnl
DOCUMENT: This parameter represents the typical or normal fraction of people, who have previously abandoned a prosthesis, that on average decides to readopt it. The reference value was estimated by prosthetists in the field based on their experience (correspondence with ProsFit Technologies).

Relative_Mortality_Risk_Adjustment = 0.5
UNITS: dmnl
DOCUMENT: This parameter represents the adjustment to Amputee Relative Mortality Risk as a result of prosthetic fitting. It has been acknowledged that prosthetic fitting is a statistically predictor of a lower mortality risk for amputees [16,17]. Based on the odds ratio found by Singh & Prasad [17], amputees who have died are 2.6 times more likely to have not been fitted with a prosthesis than those who have. Although odds ratio and relative risks are not directly interchangeable, here, we make the extrapolation that Amputees who have been fitted with a prosthesis is half as likely to die than those without.

Relative_Successful_Fitting_Rate_of_Digital = SUM(Successful_Fitting[*,Digital])//SUM(Successful_Fitting[*,Traditional])
UNITS: dmnl
DOCUMENT: This variable represents relative successful fitting rate of digital prosthesis as compared to the traditional prosthesis. The variable sums all the Successful Fitting rate by prosthesis type, and then takes the ratio of digital prosthesis to traditional. When digital successful fitting is equal to traditional successful fitting, the ratio is 1. When the ratio is less than 1, it means that there is more traditional fitting success as compared to digital. When the ratio is more than 1, it means that there is more digital fitting success than traditional.

Steepness_FRD = 1.5
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of Fitting Rate on Dropout variable. The steepness is assumed to be 1.5 but can be calibrated to data if available.

Steepness_FRR = 6
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of Fitting Rate on Readoption variable. The steepness is assumed to be 6 but can be calibrated to data if available.

Subtotal_Dropout_Rate[Prosthesis_Type] = SUM(EP_Dropout[*, Prosthesis_Type]) + SUM(ID_Dropout[*, Prosthesis_Type]) + SUM(ML_Dropout[*, Prosthesis_Type]) {SUMMING CONVERTER}
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of amputees who drop out from the fitting process at varying stages.

"Subtotal_Fitting_(Re)Entries"[Prosthesis_Type] = Subtotal_New_Fitting + Subtotal_Replacement + "Subtotal_Re-entry"
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of eligible amputees who successfully (re)enter the fitting process either for a new prosthesis, replacement, or readoption.

Subtotal_New_Fitting[Prosthesis_Type] = SUM(Fit_First_Prosthesis[*,Prosthesis_Type])
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of eligible amputees who successfully enter the first stage of the fitting process.

"Subtotal_Re-entry"[Prosthesis_Type] = SUM(Reentry[*,Prosthesis_Type])
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of amputees wanting to re-adopt a prosthesis who successfully re-enter the fitting process.

Subtotal_Readoptees[Age_Cohort] = SUM(Readoption[Age_Cohort,*])
UNITS: People/month
DOCUMENT: This variable represents the desired rate at which matured amputees without a prosthesis would like to readopt a prosthesis. In other words, the number of people per month who would like to re-start the prosthesis fitting process. This rate is simply the sum of the Readoption rate by age cohorts. Amputees are re-aggregated (no longer differentiated by prosthesis type) since they have the choice to switch between prosthesis types.

Subtotal_Readoption_Rate[Prosthesis_Type] = SUM(Readoption[*, Prosthesis_Type]) {SUMMING CONVERTER}
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of amputees who wish to re-adopt a prosthesis and re-join the fitting process.

Subtotal_Replacement[Prosthesis_Type] = SUM(Prosthesis_Replacement[*,Prosthesis_Type])
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of amputees who successfully enter the fitting process for replacing their degraded prosthesis.

Subtotal_Successful_Fitting_Rate[Prosthesis_Type] = SUM(Successful_Fitting[*,Prosthesis_Type])
UNITS: People/month
DOCUMENT: This converter sums the Successful Fitting rate across the various age groups for each prosthetic types.

Success_Fraction[Digital] = 0.9
Success_Fraction[Traditional] = 0.5
UNITS: dmnl
DOCUMENT: This parameter represents the fraction of people who have been fitted with a definitive device that would successfully adjust to it. The probability of success is related to the level of comfort or pain experienced by the amputee. According to expert opinion, digitally fitted prosthesis have a much higher success rate at 90% whereas traditional fitting yields only about 50% success (correspondence with ProsFit). The figure for traditional success rate is corroborated with literature, where two studies have observed a 43% [18] and 41.18% [19] successful fitting amongst their respective samples.

Time_to_Dropout = 1
UNITS: month
DOCUMENT: This parameter represents the time taken for amputees to decide to drop out from the prosthetic fitting process. It is assumed that amputees would take 1 month to make the decision and drop out.

Time_to_Perceive_Fitting_Rate = 36
UNITS: months
DOCUMENT: This parameter represents the time taken for the wider public to perceive the information about the relative successful fittings of the digital and traditional prosthesis type. This is assumed to be 3 years with the simple rationale that it often takes three years to form a pattern.

Total_Capacity = SUM(Market_Subsystem.Fitting_Capacity)
UNITS: People/month
DOCUMENT: This converter calculates the total fitting capacity at any one point in time. It is simply the sum of the traditional fitting capacity and the digital fitting capacity.

Total_Demand = SUM(Fitting_Demand)
UNITS: People/month
DOCUMENT: This converter calculates the total fitting demand at any one point in time. It is simply the sum of the traditional fitting demand and the digital fitting demand.

Total_Eligible_Amputee_Population = Total_Limited_Mobility+Total_Full_Mobility
UNITS: People
DOCUMENT: This converter calculates the total number of amputee population who are deemed eligible for a prosthesis. It is simply the sum of the total limited mobility population and the total full mobility population.

Total_Full_Mobility = SUM(Full_Mobility_by_Type)
UNITS: People
DOCUMENT: This converter sums the total amputees with full mobility, including both prosthesis types.

Total_Limited_Mobility = SUM(Limited_Mobility_by_Type)
UNITS: People
DOCUMENT: This converter sums the total amputees with limited mobility, including both prosthesis types.

Total_Mobility_Proportion = Total_Full_Mobility//Total_Eligible_Amputee_Population
UNITS: dmnl
DOCUMENT: This converter calculates the proportion of amputees who are fully mobile (both prosthesis type) as a fraction of the total amputee population who are deemed eligible for prosthesis. Note that it excludes those medically ineligible for prosthesis from the total amputee population.

Total_Prosthetics_Accessibility = MIN(1, Total_Capacity//Total_Demand)
UNITS: dmnl
DOCUMENT: This variable represents the total prosthetic accessibility for amputees desiring to be fitted with a new prosthesis. When fitting capacity is equal to fitting demand, the accessibility is 1, meaning 100% of all desired fittings can be accommodated. When the fraction is less than 1, it means that existing capacity can only meet a fraction of the demand. The equation includes a MIN function to limit this value from going above 1. So long as there is more capacity than demand, then prosthetists will still be able to meet 100% of all demand.

Total_Readoptees = SUM(Subtotal_Readoption_Rate)
UNITS: People/month
DOCUMENT: This converter calculates the subtotal number of amputees who wish to re-adopt a prosthesis and re-join the fitting process.

Health Care System: Health Economics Sector

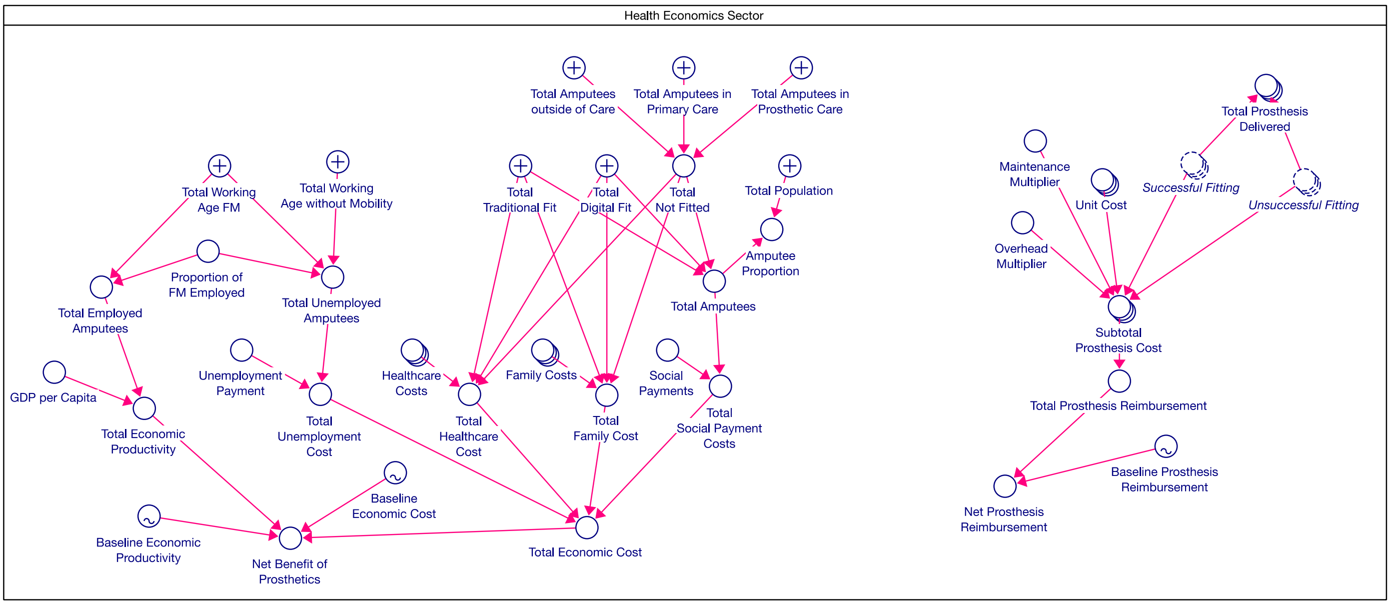

Figure S4. Stock and flow structure of health economics sector.

Table S4. Documentation for health economics sector

Health Economics Sector

Amputee_Proportion = Total_Amputees//Total_Population

UNITS: dmnl

DOCUMENT: This variable dynamically calculates the proportion of amputees in the population. It is simply the total amputee population as a fraction of the total population.

Baseline_Economic_Cost = GRAPH(TIME)

Points(481): (0.0, 210211046.132), (1.0, 210208368.795), (2.0, 210205733.911), (3.0, 210203098.019), (4.0, 210200462.049), (5.0, 210197830.626), (6.0, 210195207.909), (7.0, 210192597.469), (8.0, 210190002.417), (9.0, 210187425.455), ...

UNITS: USD/month

DOCUMENT: This time-varying converter provides the data points for Economic Cost in the baseline run. This baseline run data is subtracted from other scenarios for calculating the difference in costs.

Baseline_Economic_Productivity = GRAPH(TIME)

Points(481): (0.0, 13959120.0), (1.0, 13958899.327), (2.0, 13958839.9158), (3.0, 13958852.3867), (4.0, 13958894.4228), (5.0, 13958945.5683), (6.0, 13958994.8839), (7.0, 13959035.6795), (8.0, 13959063.5707), (9.0, 13959075.8332), ...

UNITS: USD/month

DOCUMENT: This time-varying converter provides the data points for Economic Productivity in the baseline run. This baseline run data is subtracted from other scenarios for calculating the difference in productivity.

Baseline_Prosthesis_Reimbursement = GRAPH(TIME)

Points(481): (0.0, 1938257.34666), (1.0, 1939169.27254), (2.0, 1939567.58603), (3.0, 1939737.97703), (4.0, 1939812.73499), (5.0, 1939846.32098), (6.0, 1939858.30176), (7.0, 1939855.10817), (8.0, 1939839.46721), (9.0, 1939813.71236), ...

UNITS: USD/month

DOCUMENT: This time-varying converter provides the data points for Prosthesis Reimbursement in the baseline run. This baseline run data is subtracted from other scenarios for calculating the difference in reimbursement costs.

Family_Costs[Not_Fitted] = 1653.75
Family_Costs[Traditional_Fit] = 1102.5
Family_Costs[Digital_Fit] = 735

UNITS: USD/person/month

DOCUMENT: This parameter represents the social cost borne by the families of amputees in the United Kingdom. According to ProsFit's health economic model data set, digitally fitted amputees incur the least social cost to their families [15]. The assumption here is that digitally fitted amputees end up with better health and mobility outcomes, requiring less care work from the families and therefore less opportunity cost. The yearly cost is divided by 12 to obtain the monthly cost.

GDP_per_Capita = 3675

UNITS: USD/person/month

DOCUMENT: This parameter represents the gross domestic product per capita of the United Kingdom. In ProsFit Health Economics Model, the GDP per capita is used as a proxy for the economic contribution of a working person [15]. The model also standardizes all monetary currencies for all countries to the US Dollar. The GDP per capita per annum was divided by 12 for a monthly rate.

Healthcare_Costs[Not_Fitted] = 606.42
Healthcare_Costs[Traditional_Fit] = 505.33
Healthcare_Costs[Digital_Fit] = 444.67

UNITS: USD/person/month

DOCUMENT: This parameter represents the healthcare cost associated with an amputee in the United Kingdom. According to ProsFit's health economic model data set, each type of amputee has differing healthcare costs, with digitally fitted amputees incurring the least healthcare costs [15]. The assumption here is that digitally fitted amputees end up with better health outcomes. The yearly cost is divided by 12 to obtain the monthly cost.

Maintenance_Multiplier = 1.2

UNITS: dmnl

DOCUMENT: This parameter represents the multiplier to the unit cost for taking into account the cost associated with maintenance for each prosthesis unit. The data was obtained from ProsFit's health economic model data set [15].

Net_Benefit_of_Prosthetics = (Total_Economic_Productivity-Baseline_Economic_Productivity)+(Baseline_Economic_Cost-Total_Economic_Cost)

UNITS: USD/month

DOCUMENT: This converter dynamically calculates the net benefit of digital prosthetics service provision. It is the sum of additional economic productivity and the reduction in economic costs.

Net_Prosthesis_Reimbursement = Total_Prosthesis_Reimbursement-Baseline_Prosthesis_Reimbursement

UNITS: USD/month

DOCUMENT: This converter dynamically calculates the net costs of digital prosthetics reimbursements. It is the difference between the actual prosthesis cost and baseline cost.

Overhead_Multiplier = 1.33
UNITS: dmnl
DOCUMENT: This parameter represents the multiplier to the unit cost for taking into account the overhead cost associated with manufacturing each prosthesis unit. The data was estimated from ProsFit's health economic model data set, where direct unit cost account for about 75% of the total cost [15].

Proportion_of_FM_Employed = 0.8
UNITS: dmnl
DOCUMENT: This parameter represents the proportion of amputees successfully fitted with a prosthesis who are actually employed. This number is estimated to be around 80% in the ProsFit's health economics model [15].

Social_Payments = 99.25
UNITS: USD/person/month
DOCUMENT: This parameter represents the cost of social payment per person per month in the United Kingdom, which paid to all amputees regardless of type. The annual social payment sum was obtained from ProsFit's health economic model data set, and divided by 12 for the monthly payment [15].

Subtotal_Prosthesis_Cost[Prosthesis_Type] = SUM(Successful_Fitting)*Unit_Cost*Overhead_Multiplier*Maintenance_Multiplier + SUM(Unsuccessful_Fitting)*Unit_Cost*Overhead_Multiplier
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the subtotal prosthesis cost incurred for the total devices delivered. For successful fittings, the total number of devices is multiplied by the unit cost, overhead multiplier, and maintenance multiplier. Whereas for unsuccessful fittings, there are no maintenance cost associated as the device is assumed to be abandoned soon after. The sum of the two products gives us the subtotal costs of each prosthesis type.

Total_Amputees = Total_Digital_Fit+Total_Traditional_Fit+Total_Not_Fitted
UNITS: People
DOCUMENT: This converter sums the total number of amputees in the United Kingdom at any point in time.

Total_Amputees_in_Primary_Care = SUM("Post-Op_Hospital_Care"[*]) + SUM("Pre-Op_Hospital_Care"[*]) + SUM("Recovery_(First_30_Days)"[*]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees in primary care, meaning that they are either in pre-op, post-op or recovery, prior to being referred to a prosthetist.

Total_Amputees_in_Prosthetic_Care = SUM(Definitive_Device[*, *]) + SUM(Eligible_for_Prosthesis[*, *]) + SUM(Initial_Device[*, *]) + SUM(Matured_Limb[*, *]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees in prosthetic care, meaning that they are either in one of the prosthesis fitting stages.

Total_Amputees_outside_of_Care = SUM(Awaiting_Replacement[*, *]) + SUM(Ineligible_for_Prosthesis[*]) + SUM(Limited_Mobility[*,*]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees who are outside of primary or prosthetic care and are not fitted with a prosthesis.

Total_Digital_Fit = SUM(Full_Mobility[*, Digital]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees who are successfully fitted with a digital 3D-printed prosthesis.

Total_Economic_Productivity = GDP_per_Capita*Total_Employed_Amputees
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total economic productivity of amputees, particularly from fully mobile amputees who are participating in the workforce. It is calculated by multiplying the total employed amputees with the GDP per capita.

Total_Economic_Cost = Total_Unemployment_Cost+Total_Healthcare_Cost+Total_Family_Cost+Total_Social_Payment_Costs+Total_Prosthesis_Cost
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total economic cost incurred as a result of caring for the amputee population in the United Kingdom. It is sum of the various costs: unemployment, healthcare, family, social payout, prosthesis costs.

Total_Employed_Amputees = Proportion_of_FM_Employed*Total_Working_Age_FM
UNITS: People
DOCUMENT: This variable dynamically calculates the total number of fully mobile amputees who are employed. It simply multiplies the total working age population with the proportion who are employed.

Total_Family_Cost = Family_Costs[Not_Fitted]*Total_Not_Fitted+ Family_Costs[Traditional_Fit]*Total_Traditional_Fit + Family_Costs[Digital_Fit]*Total_Digital_Fit
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total social costs borne by families of amputees. This is simply the sum of the various product of the amputee population by type and the respective family cost per person.

Total_Healthcare_Cost = Healthcare_Costs[Not_Fitted]*Total_Not_Fitted+ Healthcare_Costs[Traditional_Fit]*Total_Traditional_Fit + Healthcare_Costs[Digital_Fit]*Total_Digital_Fit
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total healthcare costs of amputees. This is simply the sum of the various product of the amputee population by type and the respective healthcare cost per person.

Total_Not_Fitted = Total_Amputees_outside_of_Care+Total_Amputees_in_Primary_Care+Total_Amputees_in_Prosthetic_Care
UNITS: People
DOCUMENT: This converter sums the total amputees who are either outside of care, in primary care or in prosthetic care. They represent the total amputees who are not fitted with a prosthesis (yet).

Total_Population = SUM("Non-PAD_Population"[*]) + SUM("Post-Op_Hospital_Care"[*]) + SUM("Pre-Op_Hospital_Care"[*]) + SUM("Recovery_(First_30_Days)"[*]) + SUM(Awaiting_Replacement[*, *]) + SUM(Definitive_Device[*, *]) + SUM(Eligible_for_Prosthesis[*, *]) + SUM(Full_Mobility[*, *]) + SUM(Ineligible_for_Prosthesis[*]) + SUM(Initial_Device[*, *]) + SUM(Limited_Mobility[*, *]) + SUM(Matured_Limb[*, *]) + SUM(PAD_Population[*]) {SUMMING CONVERTER}
UNITS: people
DOCUMENT: This summing converter totals the number of people in simulated the population.

Total_Prosthesis_Delivered[Prosthesis_Type] = SUM(Successful_Fitting)+SUM(Unsuccessful_Fitting)
UNITS: People/month
DOCUMENT: This variable dynamically calculates the total prosthesis device delivered regardless of whether it was a successful fit or not. It is arrayed by prosthesis type.

Total_Prosthesis_Reimbursement = SUM(Subtotal_Prosthesis_Cost)
UNITS: USD/month
DOCUMENT: This converter sums the total cost of providing a prosthesis, including both traditional and digital types, which is typically reimbursed by national insurance schemes.

Total_Social_Payment_Costs = Total_Amputees*Social_Payments
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total social payment costs paid out to amputees. This is simply the product of social payment per person and the total number of amputees.

Total_Traditional_Fit = SUM(Full_Mobility[*, Traditional]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees who are successfully fitted with a traditional plaster-cast prosthesis.

Total_Unemployed_Amputees = Total_Working_Age_without_Mobility+ (1-Proportion_of_FM_Employed)*Total_Working_Age_FM
UNITS: People
DOCUMENT: This variable calculates the total number of amputees who are unemployed at any one point in time. It is the sum of the total working age amputees without mobility and the proportion of fully mobile amputees who are not employed.

Total_Unemployment_Cost = Total_Unemployed_Amputees*Unemployment_Payment
UNITS: USD/month
DOCUMENT: This variable dynamically calculates the total economic cost of making unemployment payments to amputees who are not employed. This is simply the product of the total unemployed amputees and the cost of unemployment payment per person.

Total_Working_Age_FM = SUM(Full_Mobility["15_to_44",*]) + SUM(Full_Mobility["45_to_59",*]) + SUM(Full_Mobility["60_to_79", *]) {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of fully mobile amputees who are capable to work. Fully mobile, here, means that they are successfully fitted with a prosthesis and is integrated back into society.

Total_Working_Age_without_Mobility = SUM(Awaiting_Replacement["15_to_44", *]) + SUM(Awaiting_Replacement["45_to_59", *]) + SUM(Awaiting_Replacement["60_to_79", *]) + SUM(Limited_Mobility["15_to_44",*]) + SUM(Limited_Mobility["45_to_59",*]) + SUM(Limited_Mobility["60_to_79",*]) + Ineligible_for_Prosthesis["15_to_44"] + Ineligible_for_Prosthesis["45_to_59"] + Ineligible_for_Prosthesis["60_to_79"] {SUMMING CONVERTER}
UNITS: People
DOCUMENT: This summing converter totals the number of amputees who are of working age, but do not have full mobility. This includes people who are ineligible for prosthesis, those who have dropped out of the prosthetic care continuum, and those who are awaiting replacement of their prosthesis after degradation.

Unemployment_Payment = 198.42
UNITS: USD/person/month
DOCUMENT: This parameter represents the cost of unemployment payment per person per month in the United Kingdom. The annual payment sum was obtained from ProsFit's health economic model data set, and divided by 12 for the monthly payment [15].

Unit_Cost[Digital] = 1573
Unit_Cost[Traditional] = 2186
UNITS: USD/person
DOCUMENT: This parameter represents the unit cost of manufacturing a prosthesis by type. The data was obtained from ProsFit's health economic model data set [15].

Market Subsystem

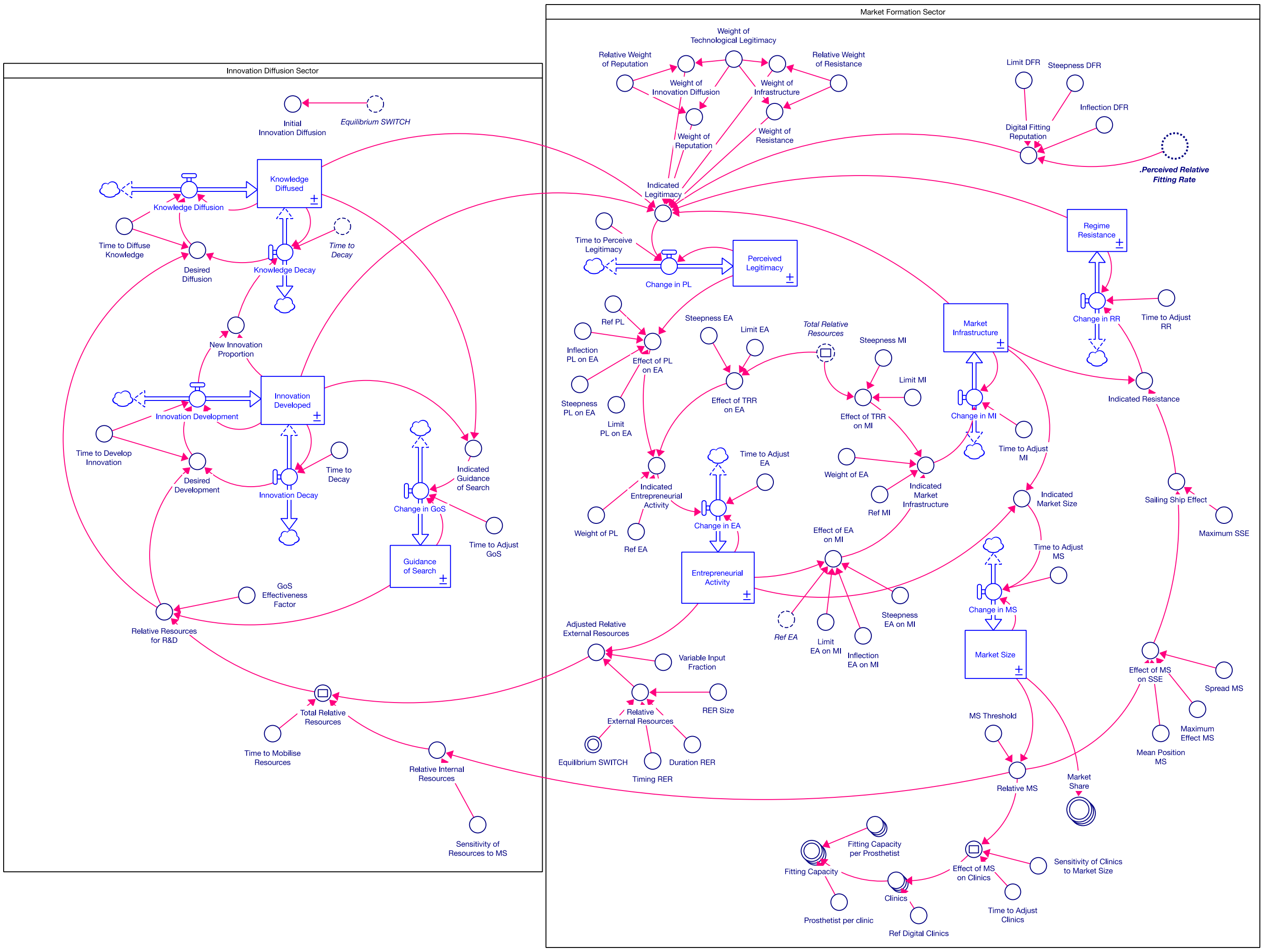

Figure S5. Stock and flow structure of market susbsystem

Table S5. Documentation for innovation diffusion sector.

Innovation Diffusion Sector
Market_Subsystem.Desired_Development = Innovation_Decay*Time_to_Develop_Innovation*Relative_Resources_for_R&D UNITS: dmnl DOCUMENT: This variable represents the desired innovation development rate. The base desired development rate is a function of the innovation decay rate and the average time taken for the development process, hence taking into account the delay time. The assumption here is that as the innovation becomes outdated, the industry at the very minimum seeks to maintain equilibrium replacement to prevent the technology from becoming obsolete. This base rate is then adjusted based on the relative resources available for research and development (R&D). When the R&D resources is at its normal level (1), then the desired development is at equilibrium replacement. When relative resources is more than 1, then the desired development is proportionally higher than the replacement rate. This means that there is room for innovation to be developed. Similarly, if the relative resources is less than 1, then the desired development is proportionally reduced – meaning that there is insufficient resources to even maintain equilibrium replacement.

Market_Subsystem.Desired_Diffusion = Knowledge_Decay*Time_to_Diffuse_Knowledge*Relative_Resources_for_R&D

UNITS: dmnl

DOCUMENT: This variable represents the desired knowledge diffusion rate. The base desired diffusion rate is a function of the knowledge decay rate and the average time taken to diffuse new knowledge, hence taking into account the delay time. The assumption here is that as the knowledge decays, the industry at the very minimum seeks to maintain equilibrium replacement to prevent obscurity. This base rate is then adjusted based on the relative resources available for research and development (R&D). When the R&D resources is at its normal level (1), then the desired diffusion is at equilibrium replacement. When relative resources is more than 1, then the desired diffusion is proportionally higher than the replacement rate. This means that there is room for new knowledge to be diffused. Similarly, if the relative resources is less than 1, then the desired diffusion is proportionally reduced – meaning that there is insufficient resources to even maintain equilibrium replacement.

Market_Subsystem.GoS_Effectiveness_Factor = 0.25

UNITS: dmnl

DOCUMENT: This parameter represents the Effectiveness Factor of the Guidance of Search function. It refers to the fraction of available resources for research and development that is subject to the influence of Guidance of Search. Here, Guidance of Search contributes up to 25% variability in the resources set for R&D, an assumption made in Walrave & Raven [20].

Market_Subsystem.Guidance_of_Search(t) = Guidance_of_Search(t - dt) + (Change_in_GoS) * dt

INIT Market_Subsystem.Guidance_of_Search = Indicated_Guidance_of_Search

UNITS: Dmnl

DOCUMENT: This stock represents the level of Guidance of Search for the technological knowledge. The Guidance of Search function "refers to those activities within the innovation system that can positively affect the visibility and clarify of specific wants among technology users" [21]. It acts as a priority setting indicator for allocating resources to R&D based on technological prominence [20]. The stock varies between 0 and 1, where 0 means the lowest level and 1 is the maximum level of Guidance of Search. The initial value of the stock is set at its indicated value.

INFLOWS:

Market_Subsystem.Change_in_GoS = (Indicated_Guidance_of_Search-Guidance_of_Search)/Time_to_Adjust_GoS

UNITS: dmnl/month

DOCUMENT: This inflow represents the rate of change in the Guidance of Search level. It is formulated as a first order adjustment, where the Guidance of Search adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Indicated_Guidance_of_Search = Innovation_Developed*Knowledge_Diffused

UNITS: dmnl

DOCUMENT: This variable represents the indicated level of the Guidance of Search prior to the delay adjustment. The indicated value is determined by the product of Innovation Developed and Knowledge Diffused. The product of the two "reflect the status" of the current innovation knowledge that is circulating amongst relevant actors [20]. A reduction in any of the two would proportionally reduce the "visibility and clarity" of the state of the art [21].

Market_Subsystem.Initial_Innovation_Diffusion = (1-Equilibrium_SWITCH)*0.01 + Equilibrium_SWITCH*0

UNITS: dmnl

DOCUMENT: This parameter is the initial value for the innovation diffusion stocks. To initialize the model in equilibrium, the initial value is 0. For dynamics in this system, the initial value is set to 0.01 to kick the stock out of its unstable equilibrium point and allow for exponential growth.

Market_Subsystem.Innovation_Developed(t) = Innovation_Developed(t - dt) + (Innovation_Development - Innovation_Decay) * dt

INIT Market_Subsystem.Innovation_Developed = Initial_Innovation_Diffusion

UNITS: Dmnl

DOCUMENT: This stock represents the level of innovation developed, or the "current state-of-the-art, with respect to technological knowledge developed" [20]. The stock varies between 0, denoting "no knowledge" or the lowest level of innovation developed, and 1, denoting "a nearly, for that moment in time, 'complete' understanding of the technology" [20].

INFLOWS:

Market_Subsystem.Innovation_Development = Desired_Development/Time_to_Develop_Innovation*MAX(0, 1-Innovation_Developed)

UNITS: Per Month

DOCUMENT: This inflow represents the innovation development rate. The rate is determined by a first order adjustment, where the desired rate is divided by the delay time. This delay adjusted rate is further controlled by the current Innovation Developed level. As the innovation reaches its maximum potential (innovation level = 1), the equation '1 - Innovation Developed' enforces "a S-shaped growth curve, typical for technological development" that makes the development of innovation to be progressively more difficult [20,22]. In essence, it prevents the stock from increasing beyond the maximum level. The MAX function prevents the inflow from going below 0.

OUTFLOWS:

Market_Subsystem.Innovation_Decay = Innovation_Developed/Time_to_Decay

UNITS: Per Month

DOCUMENT: This outflow represents the innovation decay rate since technological knowledge may become outdated over time, especially with the development of innovation. The decay rate is simply a first order adjustment where the innovation decays with a certain adjustment time (time to decay).

Market_Subsystem.Knowledge_Diffused(t) = Knowledge_Diffused(t - dt) + (Knowledge_Diffusion - Knowledge_Decay) * dt

INIT Market_Subsystem.Knowledge_Diffused = Initial_Innovation_Diffusion

UNITS: Dmnl

DOCUMENT: This stock represents the level of technological knowledge diffused amongst relevant parties. The stock varies between 0, denoting no diffusion of knowledge and 1, denoting "that nearly all currently available technological knowledge is diffused" [20].

INFLOWS:

Market_Subsystem.Knowledge_Diffusion = Desired_Diffusion/Time_to_Diffuse_Knowledge*MAX(0, 1-Knowledge_Diffused)

UNITS: dmnl/month

DOCUMENT: This inflow represents the knowledge diffusion rate. The rate is determined by a first order adjustment, where the desired rate is divided by the delay time. This delay-adjusted rate is further controlled by the current Knowledge Diffused level. As the Knowledge Diffused reaches its maximum potential (1), the equation '1 - Knowledge Diffused' enforces "a S-shaped growth curve" that makes diffusion to be progressively more difficult [20]. In essence, it prevents the stock from increasing beyond the maximum level. The MAX function prevents the inflow from going below 0.

OUTFLOWS:

Market_Subsystem.Knowledge_Decay = (Knowledge_Diffused/Time_to_Decay) + (Knowledge_Diffused*New_Innovation_Proportion)

UNITS: dmnl/month

DOCUMENT: This outflow represents the technological knowledge decay rate since diffused knowledge may become outdated over time with the development of innovation. The decay rate is a sum of a first order adjustment where the level of Knowledge Diffused decays over a certain adjustment time (time to decay) and the fraction of the knowledge diffused that is made obsolete by innovation. This formulation ensures that the level of knowledge diffused decreases pro-rata to the new innovation that is developed [20].

Market_Subsystem.New_Innovation_Proportion = Innovation_Development/Innovation_Developed

UNITS: dmnl/month

DOCUMENT: This variable calculates the ratio of the innovation development rate to the current state of the innovation. This gives a proportion of the new to old innovation level, which then gives us the pro-rate knowledge that has become obsolete.

Market_Subsystem.Relative_Internal_Resources = Relative_MS^Sensitivity_of_Resources_to_MS

UNITS: dmnl

DOCUMENT: This variable represents the relative change in Internal Resource with respect to a certain sensitivity to changes in Relative Market Size. This is calculated by taking the Sensitivity of Resources as an exponent of the Relative Market Size.

Market_Subsystem.Relative_Resources_for_R&D = Total_Relative_Resources*(1-GoS_Effectiveness_Factor) + Total_Relative_Resources*GoS_Effectiveness_Factor*Guidance_of_Search

UNITS: dmnl

DOCUMENT: This variable represents the relative resources available for research and development (R&D). It is the Total Relative Resources adjusted by the Guidance of Search level. The Effectiveness Factor determines the percentage of the Total Relative Resources that is influenced by the Guidance of Search (GoS). This percentage varies proportionally to the level of GoS. When the GoS is at its lowest (0), then the relative resources allocated to R&D will be at its fixed level (in this case, 75% of the total relative resources). When the GoS is at its maximum (1), then the relative resources for R&D will be the total relative resources (100%). For values of GoS between 0 and 1, the relative resources varies proportionally.

Market_Subsystem.Sensitivity_of_Resources_to_MS = 1

UNITS: dmnl

DOCUMENT: This parameter determines the sensitivity of Relative Internal Resources to changes in Relative Market Size. In this model, it is assumed that Internal Resources responds proportionally to changes in Market Size.

Market_Subsystem.Time_to_Adjust_GoS = 3

UNITS: month

DOCUMENT: This parameter represents the adjustment time for the Guidance of Search to update. Here, the adjustment time of 3 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Decay = 60

UNITS: month

DOCUMENT: This parameter represents the residence time of any innovation developed or diffused, or the time taken for knowledge to decay. Here, the decay time of 60 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Develop_Innovation = 12

UNITS: month

DOCUMENT: This parameter represents the delay time for the development of innovation. Here, the average delay time is assumed to be a year.

Market_Subsystem.Time_to_Diffuse_Knowledge = 12 UNITS: month DOCUMENT: This parameter represents the delay time for the diffusion of new technological knowledge. Here, the average delay time is assumed to be a year.
Market_Subsystem.Time_to_Mobilise_Resources = 6 UNITS: month DOCUMENT: This parameter represents the delay time for the mobilising resources. Here, the adjustment time of 6 months, set by Walrave & Raven [20], was kept.
Market_Subsystem.Total_Relative_Resources = SMTH1(Relative_Internal_Resources+Adjusted_Relative_External_Resources, Time_to_Mobilise_Resources) {DELAY CONVERTER} UNITS: dmnl DOCUMENT: This variable represents the Total Relative Resources available to the technological innovation system. It is the sum of the relative external and relative internal resources, adjusted by a delay time to mobilise resources. This delay process is captured by the SMTH1 function that introduces a first order delay adjustment.

Table S6. Documentation for market formation sector.

Market Formation Sector
Market_Subsystem.Adjusted_Relative_External_Resources = (1-Variable_Input_Fraction)*Relative_External_Resources + Variable_Input_Fraction*Relative_External_Resources*Entrepreneurial_Activity UNITS: dmnl DOCUMENT: This variable represents the Adjusted Relative External Resources that is actually pumped into the innovation system, by external funders. Although exogenous, Relative External Resources is influenced by the Entrepreneurial Activity level by some extent. The Variable Input Fraction determines the percentage of the resources that is dependent on the Entrepreneurial Activity. When Activity is at its lowest (0), then the relative resources will be at its fixed level (inverse of variable fraction). When the Activity is at its maximum (1), then there will be no adjustment to the Relative External Resources. For values of EA between 0 and 1, the variable portion of the relative external resources varies proportionally.
Market_Subsystem.Clinics[Digital] = Ref_Digital_Clinics*Effect_of_MS_on_Clinics Market_Subsystem.Clinics[Traditional] = 35 UNITS: clinic DOCUMENT: This variable represents the number of prosthetic clinics at any one point in time. For the traditional clinics, the number is held constant at 35 – it includes both the public-funded NHS clinics and private clinics [23]. For the digital clinics, the reference number of clinics endogenously changes with the relative Market Size.

Market_Subsystem.Digital_Fitting_Reputation = IF .Perceived_Relative_Fitting_Rate=0 THEN 0 ELSE Limit_DFR/(1+EXP((Inflection_DFR-.Perceived_Relative_Fitting_Rate)/Steepness_DFR)) UNITS: dmnl DOCUMENT: This variable represents the Reputation of Digital Fitting that dependent on the perceived relative fitting rate of the digital prosthesis as compared to the traditional one. The reputation level can vary from 0 to 1 and is analytically formulated as a Sigmoid function (s-shape curve). When the perceived ratio is 0, then we can expect reputation formed to be non-existent (0). However, as the ratio increases towards 1, we can expect the reputation of digital fitting to increase increasingly towards the mid-point (0.5), indicating a someone neutral reputation position. As the ratio increases above 1, then the reputation increases decreasingly towards the maximum of 1.

Market_Subsystem.Duration_RER = 180
UNITS: month
DOCUMENT: This parameter sets how long the external resources will be pumped into the system.

Market_Subsystem.Effect_of_EA_on_MI = IF Entrepreneurial_Activity=0 THEN 0 ELSE MIN(2, Limit_EA_on_MI/(1+EXP((Inflection_EA_on_MI-Entrepreneurial_Activity//Ref_EA)/Steepness_EA_on_MI)))
UNITS: dmnl
DOCUMENT: This variable represents the Effect of entrepreneurial activity on market infrastructure.

According Walrave & Raven [20], the relationship between the two is one of exponential growth curve, where the "influence of entrepreneurs on the formation processes of [market infrastructure] becomes increasingly large as Entrepreneurial activity increases – reflecting the need for a certain critical mass before substantial influence can be exercise."

The table function provided by the authors was replicated here with an analytical formulation. To best control the curvature and end points of the exponential growth function, a Sigmoid curve was formulated such that the inflection point ends at the desired end point (2,2). In doing so, we are able to obtain an increasing increasingly curve from (~0,0) to (2,2) with a steepness that can be calibrated.

Market_Subsystem.Effect_of_MS_on_Clinics = SMTH1(Relative_MS^Sensitivity_of_Clinics_to_Market_Size, Time_to_Adjust_Clinics) {DELAY CONVERTER}
UNITS: dmnl
DOCUMENT: This variable represents the relative change in Digital Clinics with respect to a certain sensitivity to changes in Relative Market Size. This relative change is calculated by taking the Sensitivity of Clinics as an exponent of the Relative Market Size. The relative change is further delayed with a SMTH function to take into account the time taken to set up or tear down clinics.

Market_Subsystem.Effect_of_MS_on_SSE = Maximum_Effect_MS*EXP(-(Relative_MS-Mean_Position_MS)^2/(2*Spread_MS^2))
UNITS: dmnl
DOCUMENT: This variable represents the effect of Relative Market Size on the Maximum Sailing Ship Effect. As the relative market size of the digital prosthesis industry increases beyond a threshold, we expect a sailing ship effect, or a response from the incumbent traditional prosthesis regime to step up their competitiveness. However, "the sailing ship effect is not likely to last indefinitely" and is expected to wane after the market size exceed a certain size [20]

Accordingly, the effect variable is analytically formulated as a normal distribution around a certain mean position. At the mean position, the effect is at the maximum height (1). The distribution around the mean is controlled by the spread. With this normal distribution, the effect increases towards the maximum as the relative market size increases towards 5 (corresponding to 25% market size). Beyond which, the effect decreases towards 0. The distribution references the table function provided in Walrave & Raven [20]

Market_Subsystem.Effect_of_PL_on_EA = IF Perceived_Legitimacy=0 THEN 0 ELSE MIN(2, Limit_PL_on_EA/(1+EXP((Inflection_PL_on_EA-Perceived_Legitimacy//Ref_PL)/Steepness_PL_on_EA)))
UNITS: dmnl
DOCUMENT: This variable represents the Effect of perceived legitimacy on entrepreneurial activity. According Walrave & Raven [20], the relationship between the two is one of exponential growth curve due to the "band-wagon effect" [24]. Particularly, as more entrepreneurial activity installs more infrastructure and thus increases the the perceived legitimacy of the technological system, we expect even more entrepreneurs to be interested and join the activity.

The table function provided by the authors was replicated here with an analytical formulation. To best control the curvature and end points of the exponential growth function, a Sigmoid curve was formulated such that the inflection point ends at the desired end point (2,2). In doing so, we are able to obtain an increasing increasingly curve from (~0,0) to (2,2) with a steepness that can be calibrated.

Market_Subsystem.Effect_of_TRR_on_EA = IF Total_Relative_Resources=0 THEN 0 ELSE Limit_EA*(1-EXP(-Total_Relative_Resources/Steepness_EA))

UNITS: dmnl

DOCUMENT: This variable represents the effect of total relative resources on entrepreneurial activity. External actors, be it government agencies or other private investors, could be backing entrepreneurs such that the perceived entrepreneurial risks are reduced [20,25]. Hence when total relative resources increases, we assume that funding for entrepreneurs increases.

Here, the effect of total relative resources is formulated as a nonlinear function that increases decreasingly. As funding increases beyond the normal, we can expect entrepreneurial interest to increase quickly before increasing decreasingly to the maximum as more and more resources is pumped in.

Market_Subsystem.Effect_of_TRR_on_MI = IF Total_Relative_Resources=0 THEN 0 ELSE Limit_MI*(1-EXP(-Total_Relative_Resources/Steepness_MI))

UNITS: dmnl

DOCUMENT: This variable represents the effect of total relative resources on market infrastructure. According to Walrave & Raven [20], "other actors can also stimulate development" of market infrastructure. Funding for market development can come from other such actors like government institutions that could build the necessary infrastructure for market formation [25].

Here, the effect of total relative resources is formulated as a nonlinear function that increases decreasingly. As funding increases beyond the normal, we can expect market infrastructure to expand quickly. However, as more and more money is pumped in, we expect a diminishing returns in investment, thus tailoring off to a maximum effect.

Market_Subsystem.Entrepreneurial_Activity(t) = Entrepreneurial_Activity(t - dt) + (Change_in_EA) * dt

INIT Market_Subsystem.Entrepreneurial_Activity = 0

UNITS: dmnl

DOCUMENT: This stock represents the level of entrepreneurial activities in the digital prosthetic industry. The stock varies between 0 (no activity) and 1 (full activity). The initial value of the stock is set at 0.

INFLOWS:

Market_Subsystem.Change_in_EA = (Indicated_Entrepreneurial_Activity-Entrepreneurial_Activity)/Time_to_Adjust_EA

UNITS: Per Month

DOCUMENT: This inflow represents the rate of change in the Entrepreneurial Activity stock. It is formulated as a first order adjustment, where the Entrepreneurial Activity adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Equilibrium_SWITCH = 0

UNITS: dmnl

DOCUMENT: This parameter represents the switch for setting the system in equilibrium.

Market_Subsystem.Fitting_Capacity[Prosthesis_Type] = Prosthetist_per_clinic*Clinics*Fitting_Capacity_per_Prosthetist

UNITS: People/month

DOCUMENT: This variable represents the Fitting Capacity or the number of amputees that can be seen by a prosthetist and fitted with a prosthesis per month. It is a function of the number of clinics available at any one point in time, multiplied with the average number of prosthetist per clinic, and the fitting capacity per prosthetist.

Market_Subsystem.Fitting_Capacity_per_Prosthetist[Digital] = 288/12

Market_Subsystem.Fitting_Capacity_per_Prosthetist[Traditional] = 58/12

UNITS: people/prosthetist/month

DOCUMENT: This parameter represents the average number of amputees that a prosthetist can fit in each month. The value is obtained from ProsFit's health economic model data set [15] and divided by 12 to convert the value from years to months.

Market_Subsystem.Indicated_Entrepreneurial_Activity = Ref_EA*(Effect_of_PL_on_EA*Weight_of_PL+Effect_of_TRR_on_EA*(1-Weight_of_PL))

UNITS: dmnl

DOCUMENT: This variable represents the indicated entrepreneurial activity level of the digital prosthetic industry. The indicated activity is formulated as additive effects of Perceived Legitimacy and Total Relative Resources on the Reference Entrepreneurial Activity level, governed by the respective weight of each effect. According to Walrave & Raven [20], resources available for stimulating entrepreneurial activity has an independent effect on activity. Hence, the variable is formulated as additive effects rather than multiplicative.

Market_Subsystem.Indicated_Legitimacy = (Knowledge_Diffused*Innovation_Developed)*Weight_of_Innovation_Diffusion + Digital_Fitting_Reputation*Weight_of_Reputation + (1-Regime_Resistance)*Weight_of_Resistance + Market_Infrastructure*Weight_of_Infrastructure

UNITS: dmnl

DOCUMENT: This variable represents the indicated legitimacy of the digital prosthetic industry. The indicated legitimacy is a function of "both technological legitimacy and market legitimacy" [20]. Digital Fitting Reputation and Innovation Diffusion represent the technological legitimacy, where they positively influence the indicated legitimacy. Market legitimacy is represented by Market Infrastructure and Regime Resistance. While Market Infrastructure positively influences legitimacy, Regime Resistance negatively influences legitimacy. Legitimacy is formulated as additive functions with a respective weight for each in order to ensure limit the range between 0 (no legitimacy) to 1 (full legitimacy).

Market_Subsystem.Indicated_Market_Infrastructure = Ref_MI*(Effect_of_EA_on_MI*Weight_of_EA+Effect_of_TRR_on_MI*(1-Weight_of_EA))

UNITS: dmnl

DOCUMENT: This variable represents the indicated market infrastructure level of the digital prosthetic industry. The indicated infrastructure is formulated as additive effects of Entrepreneurial Activity and Total Relative Resources on the Reference Market Infrastructure level, governed by the respective weight of each effect. According to Walrave & Raven [20], market infrastructure development is only partially determined by entrepreneurial interest; the other part of the key is the effect of funding for market development that could be supported by other actors like the government. Hence, the variable is formulated as additive effects rather than multiplicative.

Market_Subsystem.Indicated_Market_Size = Market_Infrastructure*Entrepreneurial_Activity

UNITS: dmnl

DOCUMENT: This variable represents the indicated Market Size prior to the delay adjustment. The indicated value is determined by the product of Entrepreneurial Activity and Market Infrastructure. While Market Size growths with the Entrepreneurial Activity with a delay, the market "can only truly develop when innovation system actors successfully navigate" the Market Infrastructure [20].

Market_Subsystem.Indicated_Resistance = MIN(1, (1-Market_Infrastructure) + Sailing_Ship_Effect)

UNITS: dmnl

DOCUMENT: This variable represents the indicated resistance of the incumbent traditional prosthetic industry. The indicated resistance is partially determined by the inverse of the market infrastructure. The assumption here is that the effective resistance is simply the remaining percentage of market infrastructure potential that has been prevented from being reached. The other part of resistance comes from sailing ship effect that kicks in to increase the competitiveness of the incumbent. The MIN function is added for robustness to ensure that the resistance can never increase beyond 1.

Market_Subsystem.Inflection_DFR = 1

UNITS: dmnl

DOCUMENT: This parameter sets the inflection point of the Sigmoid curve for the Digital Fitting Reputation. The inflection point is set at 1 (i.e. when the perceived relative fitting rate is at 1).

Market_Subsystem.Inflection_EA_on_MI = 2
UNITS: dmnl
DOCUMENT: This parameter sets the inflection point of the Sigmoid curve for the Effect of entrepreneurial activity on market infrastructure. The inflection point is set at 2 so that the curve only increases increasingly for the range of relative entrepreneurial activity 0 to 2.

Market_Subsystem.Inflection_PL_on_EA = 2
UNITS: dmnl
DOCUMENT: This parameter sets the inflection point of the Sigmoid curve for the Effect of perceived legitimacy on entrepreneurial activity. The inflection point is set at 2 so that the curve only increases increasingly for the range of relative entrepreneurial activity 0 to 2.

Market_Subsystem.Limit_DFR = 1
UNITS: dmnl
DOCUMENT: This parameter sets the limit of the Sigmoid curve for the Digital Fitting Reputation, which prevents it from growing above 1.

Market_Subsystem.Limit_EA = 2
UNITS: dmnl
DOCUMENT: This parameter sets the limit that the exponential decay function approaches, thereby controlling the maximum effect at 2. The maximum is set as such in order to prevent entrepreneurial activity from exceeding beyond 1.

Market_Subsystem.Limit_EA_on_MI = 4
UNITS: dmnl
DOCUMENT: This parameter sets the limit that is approached by the Sigmoid curve for the Effect of entrepreneurial activity on market infrastructure. By doubling the limit, then we can set the inflection point at (2,2), the desired end point for the exponential curve part of the Sigmoid function.

Market_Subsystem.Limit_MI = 2
UNITS: dmnl
DOCUMENT: This parameter sets the limit that the exponential decay function approaches, thereby controlling the maximum effect at 2. The maximum is set as such in order to prevent market infrastructure from exceeding beyond 1.

Market_Subsystem.Limit_PL_on_EA = 4
UNITS: dmnl
DOCUMENT: This parameter sets the limit that is approached by the Sigmoid curve for the Effect of perceived legitimacy on entrepreneurial activity. By doubling the limit, then we can set the inflection point at (2,2), the desired end point for the exponential curve part of the Sigmoid function.

Market_Subsystem.Market_Infrastructure(t) = Market_Infrastructure(t - dt) + (Change_in_MI) * dt
INIT Market_Subsystem.Market_Infrastructure = Indicated_Market_Infrastructure
UNITS: dmnl
DOCUMENT: This stock represents the Market Infrastructure of the digital prosthetic industry. The stock varies between 0 (no infrastructure developed) and 1 (full market infrastructure). The initial value of the stock is set at its indicated value.

INFLOWS:
Market_Subsystem.Change_in_MI = (Indicated_Market_Infrastructure - Market_Infrastructure)/Time_to_Adjust_MI
UNITS: Per Month
DOCUMENT: This inflow represents the rate of change in the Market Infrastructure. It is formulated as a first order adjustment, where the Market Infrastructure adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Market_Share[Digital] = Market_Size
Market_Subsystem.Market_Share[Traditional] = 1-Market_Size
UNITS: dmnl
DOCUMENT: This variable represents the respective Market Shares of the digital and traditional prosthetic industry. The digital market share is assumed to be directly proportional to the Market Size, which is taken as percentage between 0 to 1. The traditional market size is simply the inverse of the digital market share.

Market_Subsystem.Market_Size(t) = Market_Size(t - dt) + (Change_in_MS) * dt
INIT Market_Subsystem.Market_Size = 0
UNITS: dmnl
DOCUMENT: This stock represents the Market Size of the digital prosthetic industry. The stock varies between 0 and 1, where 0 means the industry failed to capture any prosthetic market, and 1 indicates 100% of the prosthetic market is captured by the digital industry. The initial value of the stock is set at 0.

INFLOWS:
Market_Subsystem.Change_in_MS = (Indicated_Market_Size-Market_Size)/Time_to_Adjust_MS
UNITS: Per Month
DOCUMENT: This inflow represents the rate of change in the Market Size. It is formulated as a first order adjustment, where the Market Size adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Maximum_Effect_MS = 1
UNITS: dmnl
DOCUMENT: This parameter sets the Maximum Effect of MS on the Maximum SSE. The maximum effect is 1, indicating that at the normal or mean position, the sailing ship effect will be at its maximum.

Market_Subsystem.Maximum_SSE = 0.25
UNITS: dmnl
DOCUMENT: This parameter represents the maximum Sailing Ship Effect. Here, the maximum effect of 0.25, set by Walrave & Raven [20], was kept.

Market_Subsystem.Mean_Position_MS = 5
UNITS: dmnl
DOCUMENT: This parameter sets the normal or mean position of the relative market size. Here, the maximum effect will occur when the relative size is 5. This value was chosen as it corresponds to 0.25 (5 times the threshold), which is the threshold size before the sailing ship wanes according to Walrave & Raven [20].

Market_Subsystem.MS_Threshold = 0.05
UNITS: dmnl
DOCUMENT: This parameter represents the Market Size Threshold that acts as the reference value for the Relative Market Size. Here, the threshold is set at 0.05, meaning that the minimum viability of the digital technology industry is 5%. The assumption here is that below 5% the industry is still in the red and is not profiting enough for long-term viability.

Market_Subsystem.Perceived_Legitimacy(t) = Perceived_Legitimacy(t - dt) + (Change_in_PL) * dt
INIT Market_Subsystem.Perceived_Legitimacy = Indicated_Legitimacy
UNITS: dmnl
DOCUMENT: This stock represents the Perceived Legitimacy of system actors towards the digital prosthetic industry. The stock varies between 0 and 1, where 0 indicates a complete lack of legitimacy, and 1 indicates a very high level of legitimacy. The initial value of the stock is set at its indicated value.

INFLOWS:

Market_Subsystem.Change_in_PL = (Indicated_Legitimacy-Perceived_Legitimacy)/Time_to_Perceive_Legitimacy

UNITS: Per Month

DOCUMENT: This inflow represents the rate of change in the Perceived Legitimacy. It is formulated as a first order adjustment, where the Perceived Legitimacy adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Prosthetist_per_clinic = 2

UNITS: prosthetist/clinic

DOCUMENT: This parameter represents the average number of prosthetist in each clinic. The value is obtained from ProsFit's health economic model data set [15].

Market_Subsystem.Ref_Digital_Clinics = 3

UNITS: clinic

DOCUMENT: This parameter represents the reference number of digital clinics in the United Kingdom. This number is calibrated to 3 based on the projected number of digital clinics in the future based on ProsFit's health economic model data set [15].

Market_Subsystem.Ref_EA = 0.5

UNITS: dmnl

DOCUMENT: The reference Entrepreneurial Activity is set at 0.5, the mid value of the stock which ranges from 0 to 1.

Market_Subsystem.Ref_MI = 0.5

UNITS: dmnl

DOCUMENT: The reference market infrastructure is set at 0.5, the mid value of the stock which ranges from 0 to 1.

Market_Subsystem.Ref_PL = 0.5

UNITS: dmnl

DOCUMENT: The reference Perceived Legitimacy is set at 0.5, the mid value of the stock which ranges from 0 to 1.

Market_Subsystem.Regime_Resistance(t) = Regime_Resistance(t - dt) + (Change_in_RR) * dt

INIT Market_Subsystem.Regime_Resistance = 1

UNITS: dmnl

DOCUMENT: This stock represents the Regime Resistance of the incumbent traditional prosthetic industry, then campaigns to counter the growth of the digital market. The stock varies between 0 and 1, where 0 means there is no resistance, and 1 implies a severe resistance that suppresses the digital industry.

INFLOWS:

Market_Subsystem.Change_in_RR = (MIN(Indicated_Resistance, 1) - Regime_Resistance)/Time_to_Adjust_RR

UNITS: Per Month

DOCUMENT: This inflow represents the rate of change in the Regime Resistance. It is formulated as a first order adjustment, where the Regime Resistance adjusts to its indicated level with a certain adjustment time.

Market_Subsystem.Relative_External_Resources = IF TIME>=Timing_RER AND TIME<Timing_RER+Duration_RER AND Equilibrium_SWITCH=0 THEN RER_Size ELSE 0

UNITS: dmnl

DOCUMENT: This variable represents the Relative External Resources that is being pumped into the system at any one point in time. The equation sets External Funding to be temporary. The amount is only starts to be pumped from the Timing set and for a certain Duration before returning back to 0.

Market_Subsystem.Relative_MS = Market_Size//MS_Threshold
UNITS: dmnl
DOCUMENT: This variable calculates the Relative Market Size, the ratio of the current Market Size relative to the Threshold. When the ratio is 1, it means that the Market Size is at the threshold level. If the ratio is less than 1, it means that the market size is not viable. And if the ratio is more than 1, then it indicates that relative market size is above the viability threshold.

Market_Subsystem.Relative_Weight_of_Reputation = 0.6
UNITS: dmnl
DOCUMENT: This parameter represents the relative weight distribution of Reputation to Innovation Distribution. Here, it is assumed that Reputation has a slightly higher weight (60%) than Innovation Diffusion (40%) as investors react more favourably to proven success of the technology rather than its potential.

Market_Subsystem.Relative_Weight_of_Resistance = 0.6
UNITS: dmnl
DOCUMENT: This parameter represents the relative weight distribution of Resistance to Market Infrastructure. Here, it is assumed that Resistance has a slightly higher weight (60%) than Market Infrastructure (40%) as investors tend to react more strongly to possible negative repercussion from competition.

Market_Subsystem.RER_Size = 5
UNITS: dmnl
DOCUMENT: This parameter sets the size of the relative external resources. This number changes based on the different experimental scenarios.

Market_Subsystem.Sailing_Ship_Effect = Maximum_SSE*Effect_of_MS_on_SSE
UNITS: dmnl
DOCUMENT: This variable dynamically calculates the Sailing Ship Effect. The maximum effect is endogenously adjusted with changes in the relative Market Size.

Market_Subsystem.Sensitivity_of_Clinics_to_Market_Size = 0.5
UNITS: dmnl
DOCUMENT: This parameter determines the sensitivity of Digital Clinics to changes in Relative Market Size. The number of clinics is not as sensitive to changes in Market Size and adjusts less than proportionally.

Market_Subsystem.Spread_MS = 0.25
UNITS: dmnl
DOCUMENT: This parameter sets the dispersion around the mean in the normal distribution. This value was calibrated to fit the table function provided by Walrave & Raven [20], where the values are distributed between 0 and 0.3 market size.

Market_Subsystem.Steepness_DFR = 0.2
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Digital Fitting Reputation. The steepness is assumed to 0.2, which can be further calibrated with data collection.

Market_Subsystem.Steepness_EA = 2.5
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of total relative resources on entrepreneurial activity. The steepness is assumed to be 2.5, and can be calibrated with more robust data collection.

Market_Subsystem.Steepness_EA_on_MI = 0.4
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of entrepreneurial activity on market infrastructure. The steepness is set to 0.4 to fit the table function provided by Walrave & Raven [20].

Market_Subsystem.Steepness_MI = 2.5
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of total relative resources on market infrastructure. The steepness is assumed to be 2.5, and can be calibrated with more robust data collection.

Market_Subsystem.Steepness_PL_on_EA = 0.4
UNITS: dmnl
DOCUMENT: This parameter controls the steepness of the curve or the rate of increase or decline of the Effect of perceived legitimacy on entrepreneurial activity. The steepness is set to 0.4 to fit the table function provided by Walrave & Raven [20]

Market_Subsystem.Time_to_Adjust_Clinics = 24
UNITS: months
DOCUMENT: This parameter represents the delay time to adjust clinics. Here, it is assumed to be 24 months to set up clinics.

Market_Subsystem.Time_to_Adjust_EA = 12
UNITS: month
DOCUMENT: This parameter represents the adjustment time for a change in the entrepreneurial activity. Here, the adjustment time of 12 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Adjust_MI = 60
UNITS: month
DOCUMENT: This parameter represents the adjustment time for a change in the market infrastructure. Here, the adjustment time of 60 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Adjust_MS = 24
UNITS: month
DOCUMENT: This parameter represents the adjustment time for a change in the market size. Here, the adjustment time of 24 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Adjust_RR = 12
UNITS: month
DOCUMENT: This parameter represents the adjustment time for a change in the Regime Resistance. Here, the adjustment time of 12 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Time_to_Perceive_Legitimacy = 12
UNITS: month
DOCUMENT: This parameter represents the adjustment time for a change in perceived legitimacy of digital technology. Here, the adjustment time of 12 months, set by Walrave & Raven [20], was kept.

Market_Subsystem.Timing_RER = 96
UNITS: month
DOCUMENT: This parameter sets the start time for the external resources to be pumped into the system.

Market_Subsystem.Variable_Input_Fraction = 0.25
UNITS: dmnl
DOCUMENT: This parameter represents the Variable portion of the Relative External Resources. It refers to the fraction of resources that is subject to the influence of Entrepreneurial Activity, which is assumed to be 25% by Walrave & Raven [20].

Market_Subsystem.Weight_of_EA = 0.4
UNITS: dmnl
DOCUMENT: This parameter represents the weight of Entrepreneurial Activity. Here, it is assumed to be 0.4, meaning that slightly less weight is placed on entrepreneurial interest than on the effect of funding for market development.

Market_Subsystem.Weight_of_Infrastructure = (1-Weight_of_Technological_Legitimacy)*(1-Relative_Weight_of_Resistance)
UNITS: dmnl
DOCUMENT: This converter calculates the weight of the Infrastructure. It is simply the product of the inverse of the weight of technological legitimacy and the inverse of the relative weight of resistance.

Market_Subsystem.Weight_of_Innovation_Diffusion = Weight_of_Technological_Legitimacy*(1-Relative_Weight_of_Reputation)
UNITS: dmnl
DOCUMENT: This converter calculates the weight of the Innovation Diffusion. It is simply the product of the weight of technological legitimacy and the inverse of the relative weight of reputation.

Market_Subsystem.Weight_of_PL = 0.5
UNITS: dmnl
DOCUMENT: This parameter represents the weight of Perceived Legitimacy. Here, both perceived legitimacy and effect of total relative resources are assumed to have equal weight distribution.

Market_Subsystem.Weight_of_Reputation = Weight_of_Technological_Legitimacy*Relative_Weight_of_Reputation
UNITS: dmnl
DOCUMENT: This converter calculates the weight of the Reputation. It is simply the product of the weight of technological legitimacy and the relative weight of reputation.

Market_Subsystem.Weight_of_Resistance = (1-Weight_of_Technological_Legitimacy)*Relative_Weight_of_Resistance
UNITS: dmnl
DOCUMENT: This converter calculates the weight of the Resistance. It is simply the product of the inverse of the weight of technological legitimacy and the relative weight of resistance.

Market_Subsystem.Weight_of_Technological_Legitimacy = 0.5
UNITS: dmnl
DOCUMENT: This parameter represents the relative Weight of Technological Legitimacy to Market Legitimacy. Here, the distribution of weight is assumed to be equal between the two types. "Technological Legitimacy" is conceptualized as functions of innovation diffusion and reputation of digital fittings, while "Market Legitimacy" is conceptualized as function of Market Infrastructure and Regime Resistance [20].

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