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APPENDICES

Appendix I

Fish Bone Diagram For Rice Operational Process

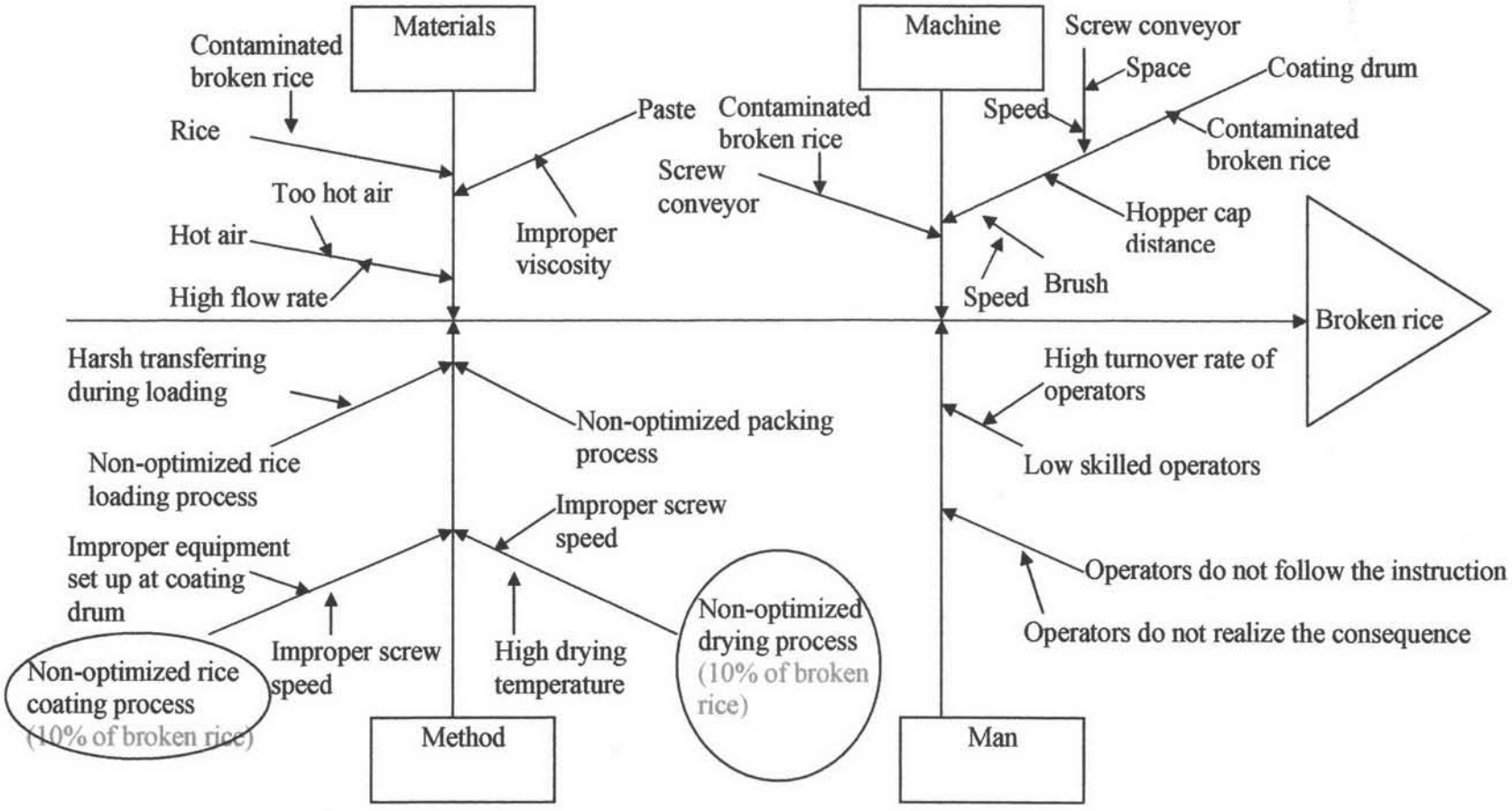
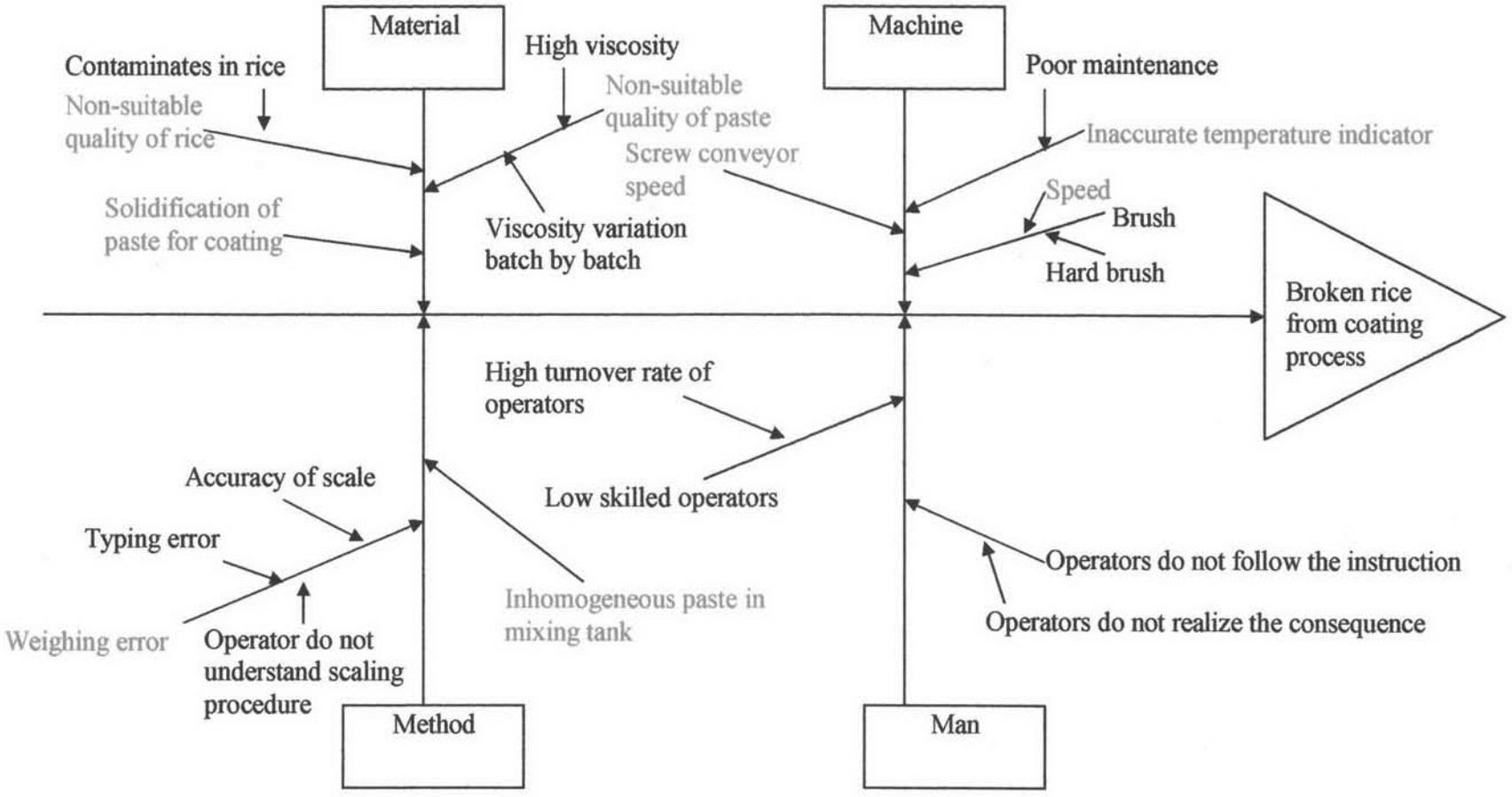


Figure A1.1: Fish bone diagram for cause and effect analysis: broken rice from overall rice operational process

Table A1.1: Cause and effect analysis: overall rice operational process according to Figure A1.1

Causes of broken rice	Controllable/Uncontrollable	Effect
1. Contaminated broken rice	Uncontrollable due to different sources of rice having different contamination	Major effect
2. Improper paste viscosity	Controllable due to we can adjust paste viscosity by varying the paste ingredient	Minor effect
3. Too hot air	Controllable due to we can control temperature of hot air	Minor effect
4. High flow rate of hot air	Controllable due to we can control flow rate of hot air	Minor effect
5. Space in screw conveyor	Controllable due to we can adjust space in screw conveyor	Minor effect
6. Speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Minor effect
7. Hopper cap distance in coating drum	Controllable due to we can adjust hopper cap distance	Major effect
8. Brush speed in coating drum	Controllable due to we can adjust brush speed	Minor effect
9. Harsh transferring during loading	Controllable due to we can control loading process to be softer	Minor effect
10. Non-optimized packing process	Controllable due to proper work instruction can optimize packing process	Minor effect
11. Non-optimized rice coating process	Controllable due to we can adjust some parameters in coating process to be more optimize	Major effect
12. Non-optimized drying process	Controllable due to we can adjust drying time according to the particular feed	Major effect
13. Improper screw speed at drying process	Controllable due to we can adjust screw speed at drying process	Minor effect
14. High drying temperature	Controllable due to we can adjust drying temperature	Major effect
15. High turnover rate of operators	Uncontrollable due to resignation of operators depends on them	Minor effect
16. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
17. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect



A1.2: Fish bone diagram for cause and effect analysis: broken rice from coating process

Table A1.2: Cause and effect analysis: broken rice from coating process according to Figure A1.3

Causes of broken rice	Controllable/Uncontrollable	Effect
1. Non-suitable quality of rice	Controllable due to we can improve quality of rice by appropriate working procedures and QC	Major effect
2. Non-suitable quality of paste	Controllable due to we can improve quality of paste by appropriate working procedures and QC	Major effect
3. Solidification of paste for coating	Controllable due to we can adjust viscosity and temperature of paste to prevent solidification	Major effect
4. Improper speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Major effect
5. Inaccurate temperature indicator during coating	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
6. Improper brush speed in coating drum	Controllable due to we can control brush speed	Major effect
7. Hard brush	Uncontrollable due to we cannot change brush	Minor effect
8. Weighing error	Controllable due to we can issue appropriate work instruction to reduce error	Major effect
9. Inhomogeneous paste in mixing tank	Controllable due to we can adjust speed and mixing time to make paste homogeneous	Major effect
10. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
11. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

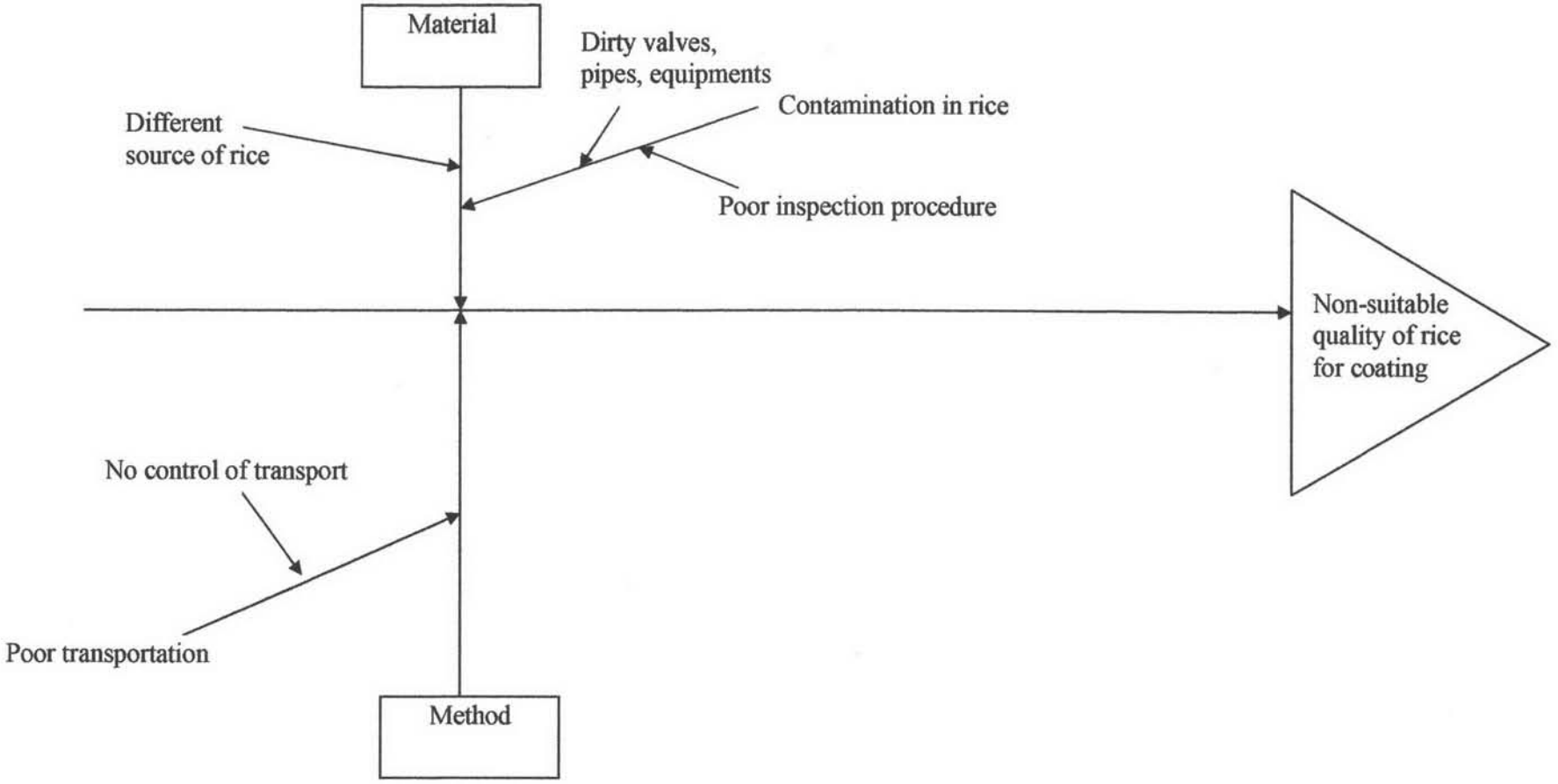


Figure A1.3: Fish bone diagram for cause and effect analysis: non-suitable quality of rice for coating

Table A1.3: Cause and effect analysis for non-suitable quality of rice for coating at coating process according to Figure A1.7

Causes of non-suitable quality of rice for coating	Controllable/Uncontrollable	Effect
1. Poor transportation	Uncontrollable due to its depends on the transportation from merchandises to the factory	Minor effect
2. Different sources of rice	Uncontrollable due to we cannot specify the source of rice	Minor effect
3. Contamination in rice due to poor inspection procedure	Controllable due to we can improve our inspection procedure	Major effect
4. Contamination in rice due to dirty valves, pipes and equipments	Controllable due to we can clean equipments to reduce contamination	Major effect

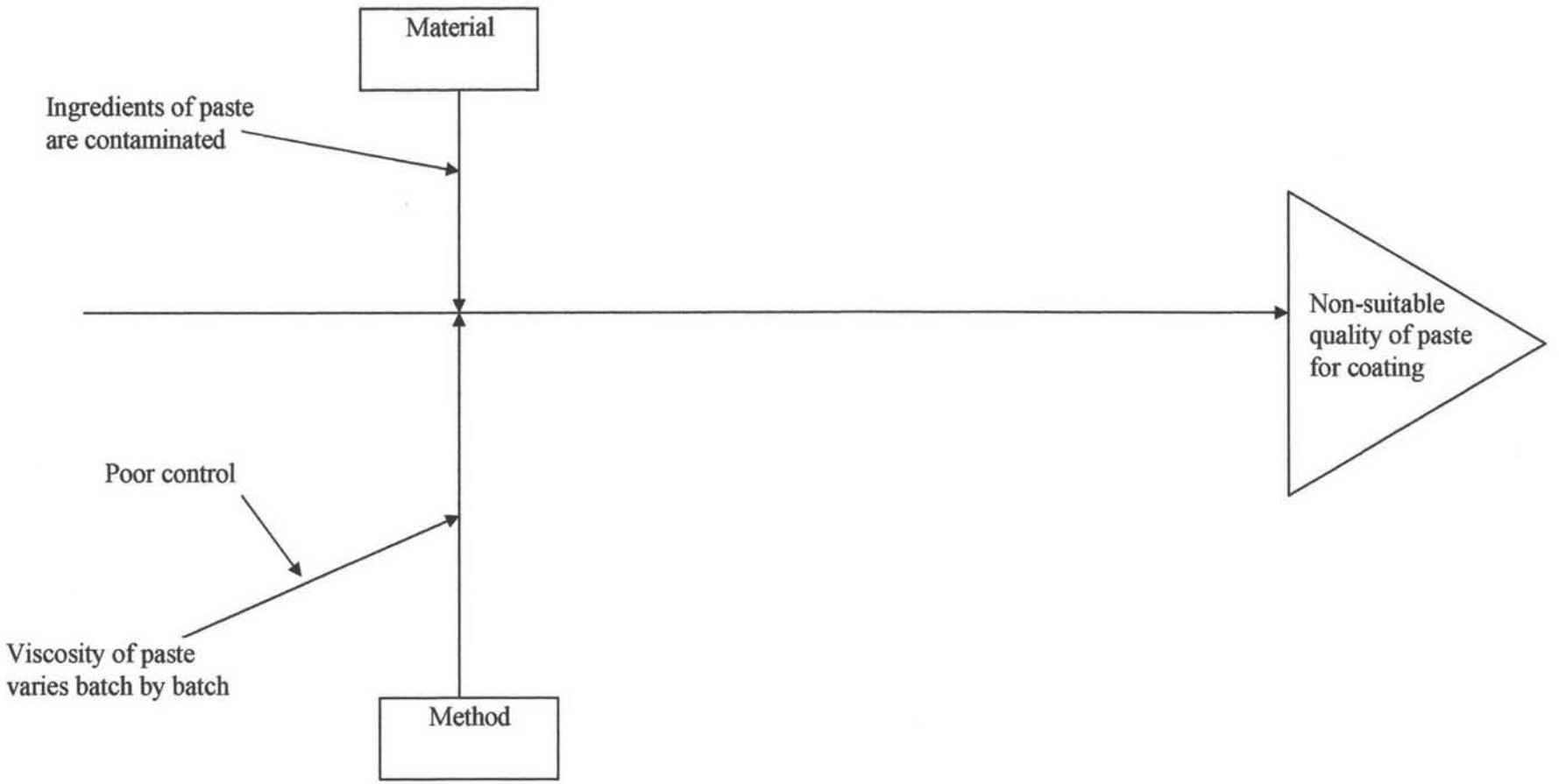


Figure A1.4: Fish bone diagram for cause and effect analysis: non-suitable quality of paste for coating

Table A1.4: Cause and effect analysis for non-suitable quality of paste for coating at coating process according to Figure A1.8

Causes of non-suitable quality of paste for coating	Controllable/Uncontrollable	Effect
1. Ingredient of paste are contaminated	Controllable due to we can issue appropriate work instruction to avoid contamination	Major effect
2. Viscosity of paste varies batch by batch	Uncontrollable due to we used several types of paste in the process	Major effect

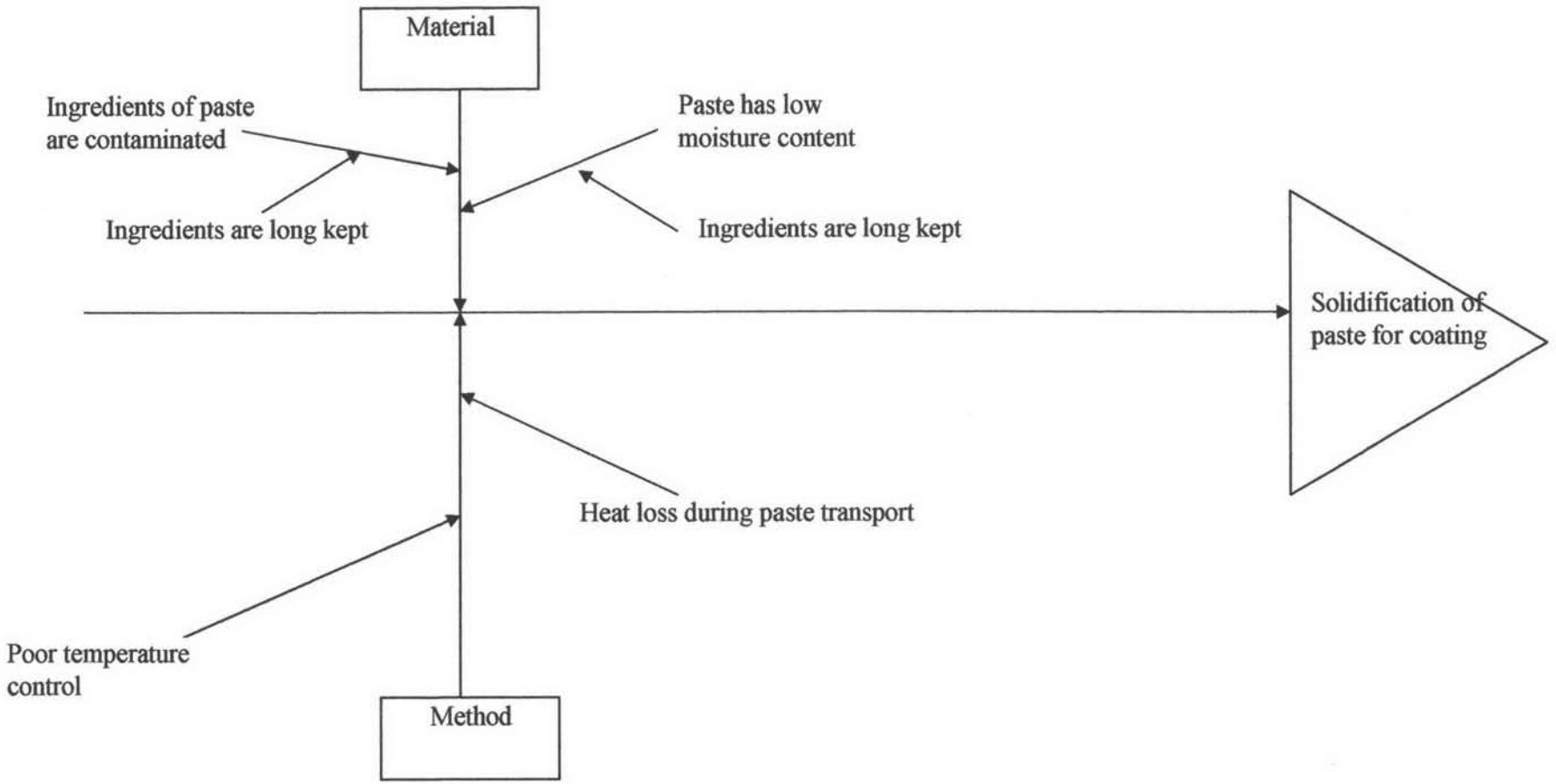


Figure A1.5: Fish bone diagram for cause and effect analysis: solidification of paste for coating

Table A1.5: Cause and effect analysis for solidification of paste for coating at coating process according to Figure A1.9

Causes of solidification of paste for coating	Controllable/Uncontrollable	Effect
1. Ingredient of paste are contaminated	Controllable due to we can issue appropriate work instruction to avoid contamination	Minor effect
2. Paste has low moisture content	Controllable due to we can add more water	Major effect
3. Poor temperature control	Uncontrollable due to we do not have heating system after paste mixing and before coating	Major effect
4. Heat loss during paste transport	Uncontrollable due to we do not have insulation around the transporting pipes	Major effect

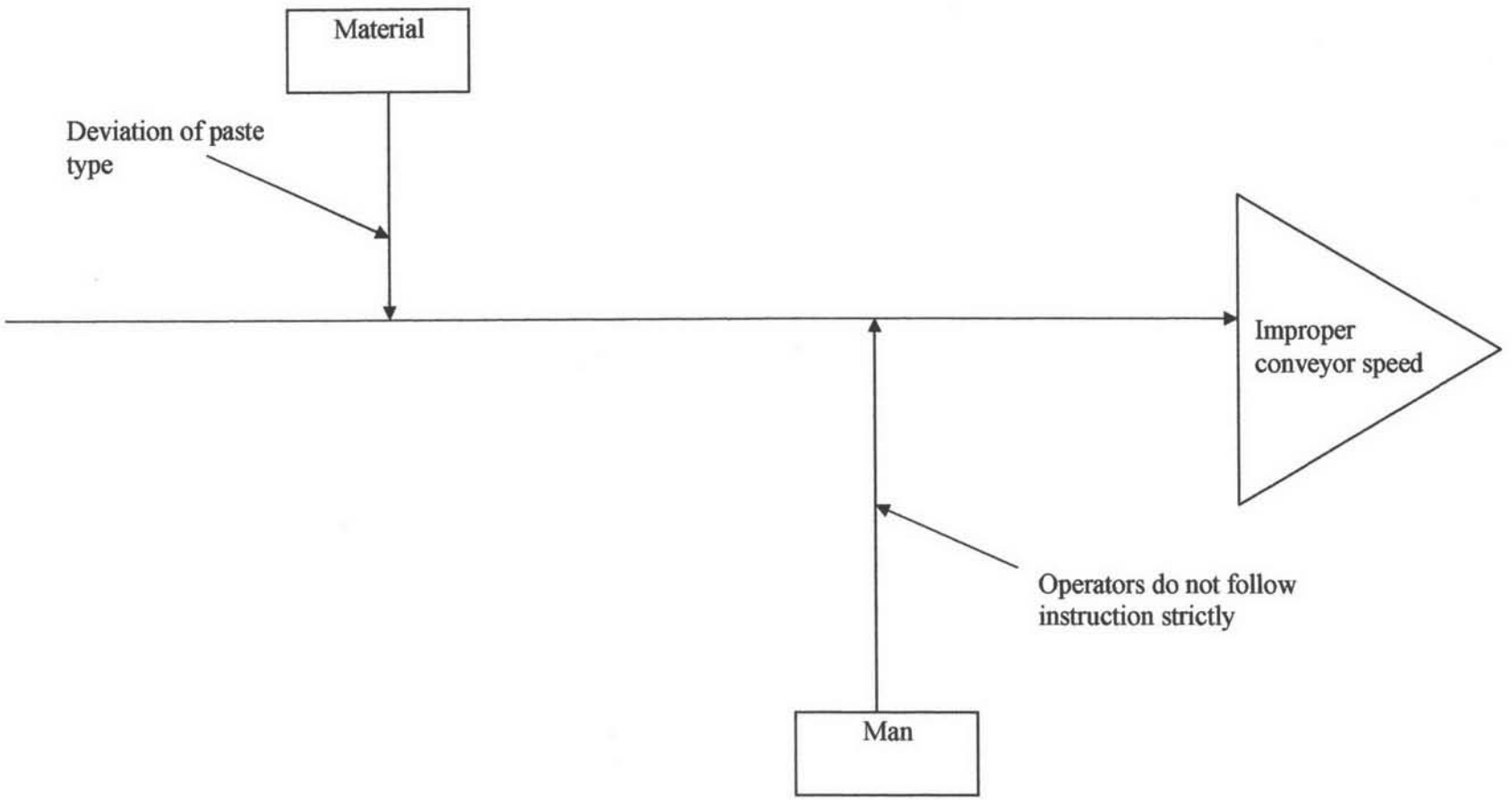


Figure A1.6: Fish bone diagram for cause and effect analysis: Improper conveyor speed

Table A1.6: Cause and effect analysis for improper conveyor speed at coating process according to Figure A1.16

Causes of improper conveyor speed	Controllable/uncontrollable	Effect
1. Deviation of paste type	Uncontrollable due to several types of paste are used at the factory	Major effect
2. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

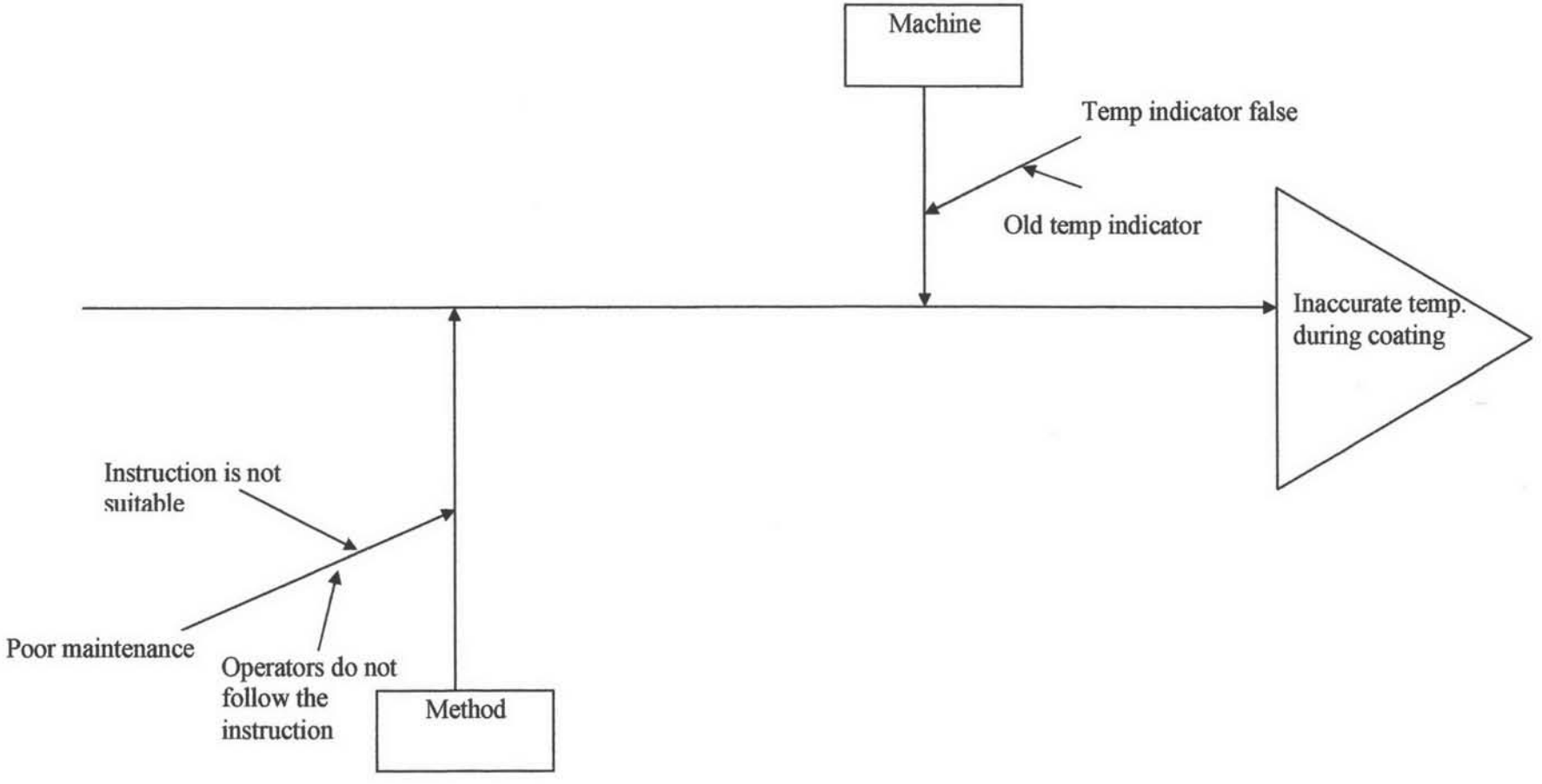


Figure A1.7: Fish bone diagram for cause and effect analysis: inaccurate temperature during coating

Table A1.7: Cause and effect analysis for inaccurate temperature during coating at coating process according to Figure A1.10

Causes of inaccurate temperature during coating	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Poor maintenance	Controllable due to we can set up preventive maintenance plan	Major effect

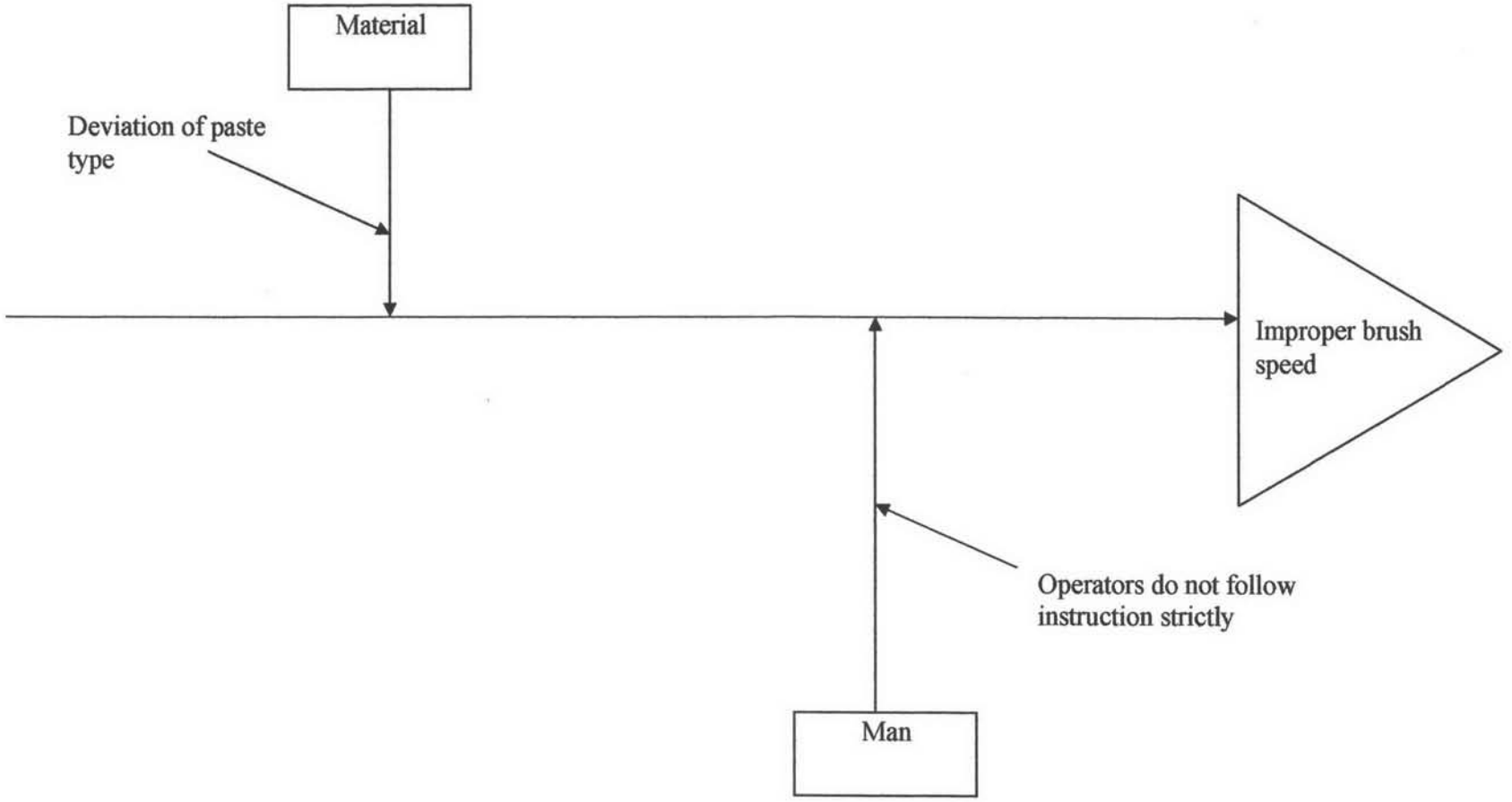


Figure A1.8: Fish bone diagram for cause and effect analysis: Improper brush speed

Table A1.8: Cause and effect analysis for improper brush speed at coating process according to Figure A1.15

Causes of improper brush speed	Controllable/Uncontrollable	Effect
1. Deviation of paste type	Uncontrollable due to several types of paste are used at the factory	Major effect
2. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

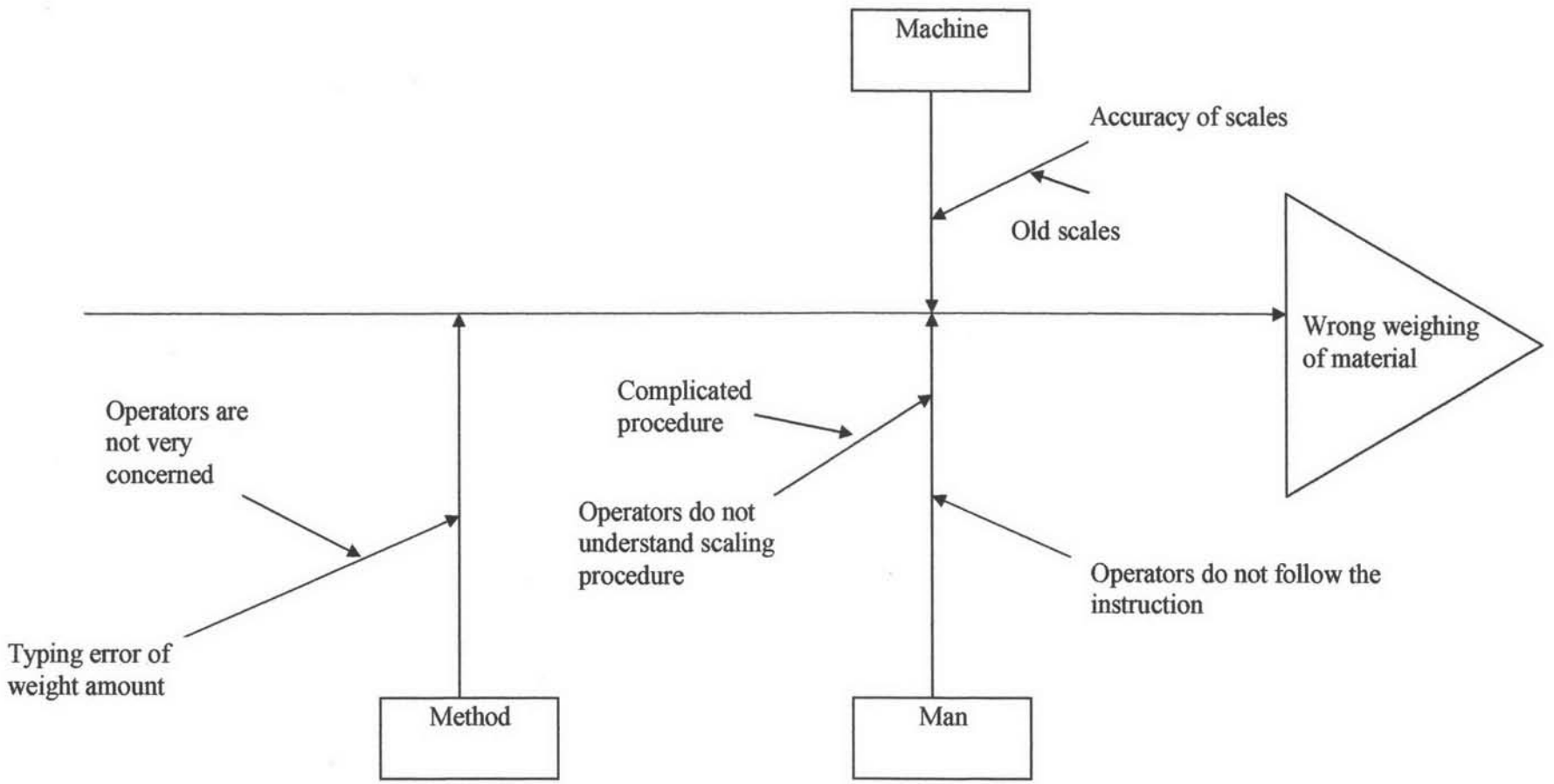


Figure A1.9: Fish bone diagram for cause and effect analysis: wrong weighing of materials

Table A1.9: Cause and effect analysis for wrong weighing of material at coating process according to Figure A1.11

Causes of wrong weighing of material	Controllable/Uncontrollable	Effect
1. Accuracy of scales	Controllable due to we can set up calibration schedule to control accuracy of scales	Major effect
2. Typing error of weight amount	Uncontrollable due to it depends on operators	Major effect
3. Operators do not understand scaling procedure	Controllable due to we can set up training to ensure that operators understand the scaling procedure	Major effect
4. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

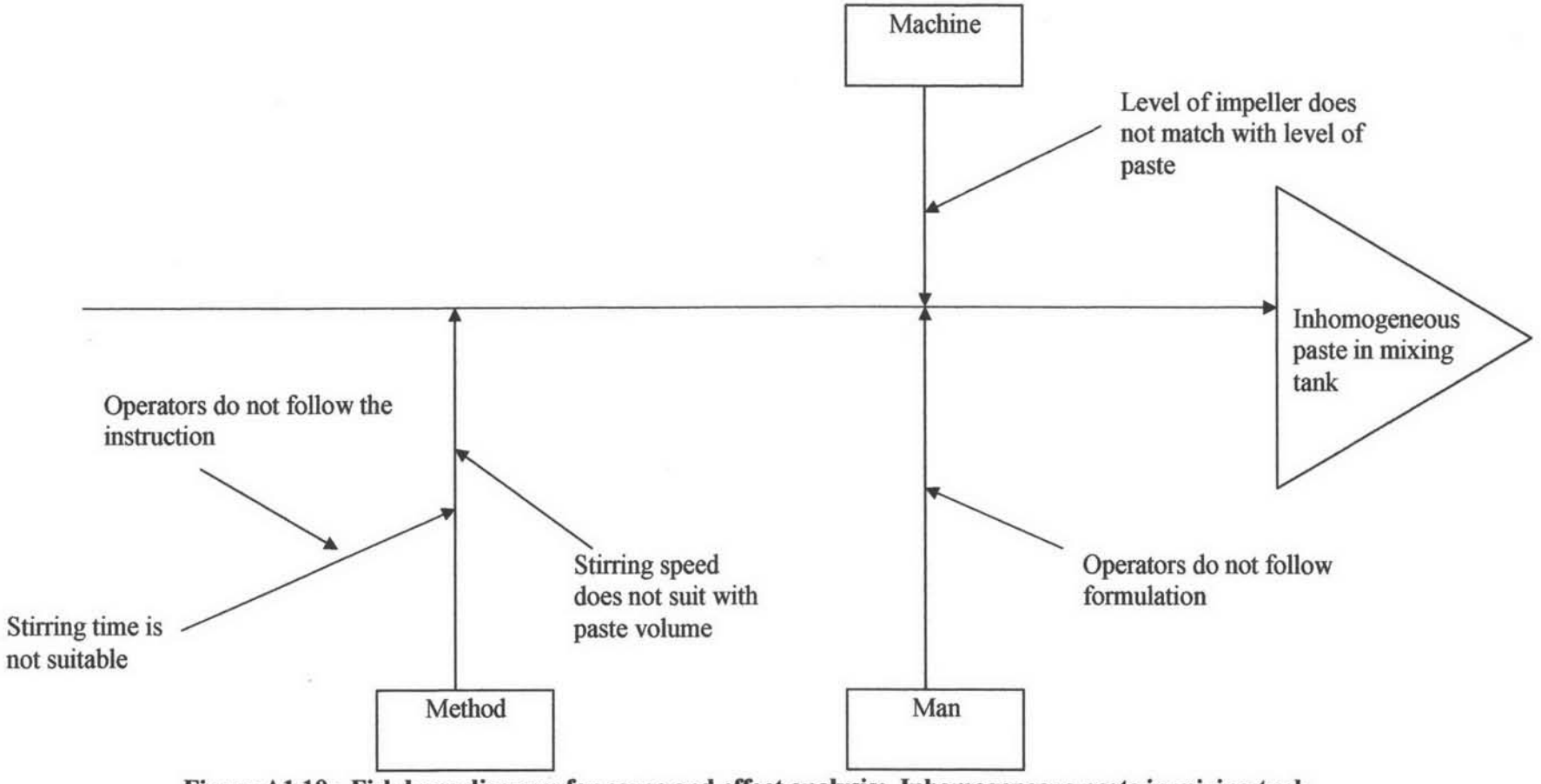
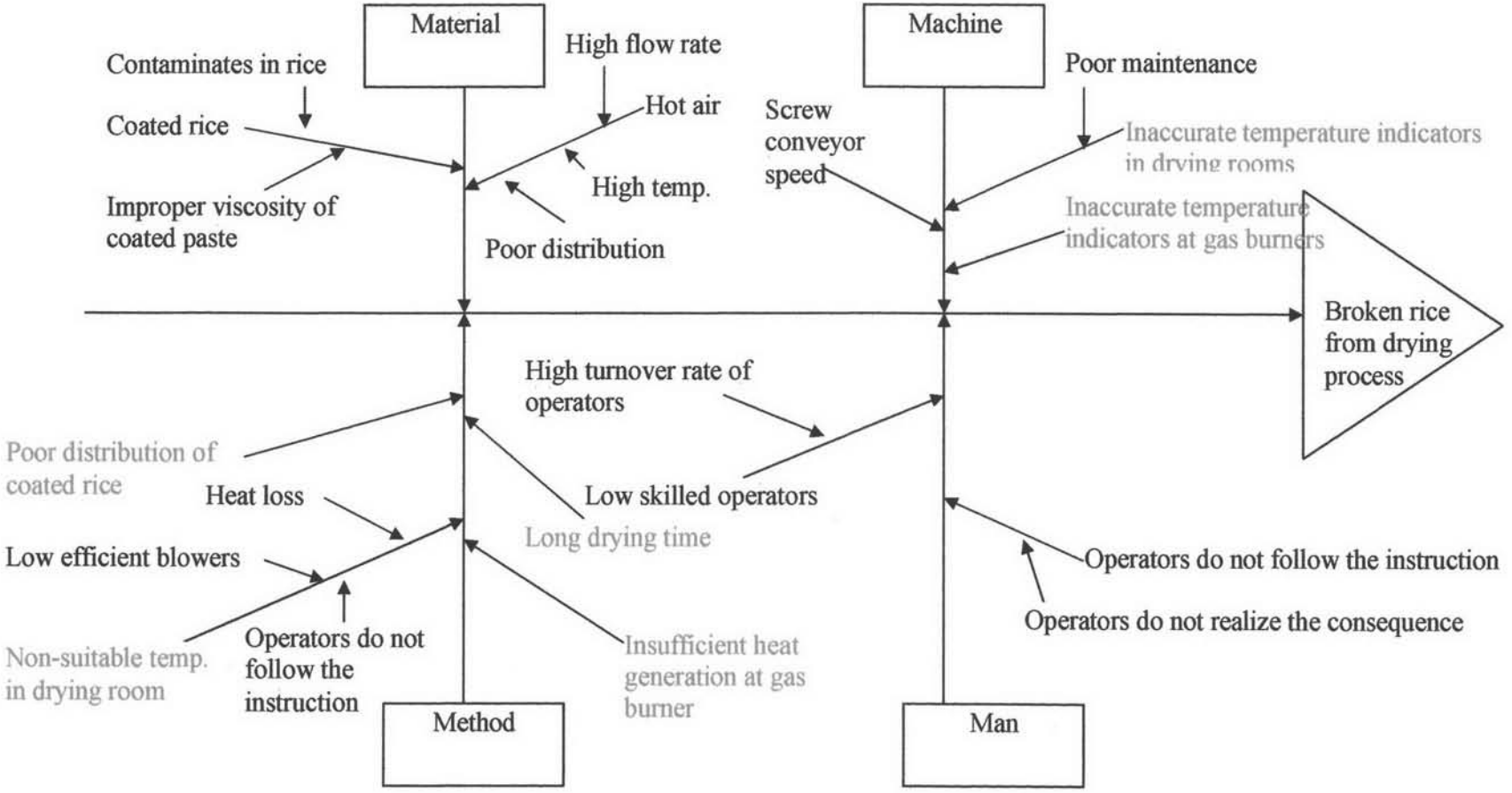


Figure A1.10: Fish bone diagram for cause and effect analysis: Inhomogeneous paste in mixing tank

Table A1.10: Cause and effect analysis for inhomogeneous paste in mixing tank at coating process according to Figure A1.14

Causes of inhomogeneous paste in mixing tank	Controllable/Uncontrollable	Effect
1. Level of impeller does not match with level of paste	Controllable due to we can adjust level of impeller in the mixing tanks	Major effect
2. Stirring time is not suitable	Controllable due to we can adjust stirring time easily	Major effect
3. Stirring speed does not suit with paste volume	Controllable due to we can adjust stirring speed easily	Major effect
4. Operators do not follow formulation	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect



A1.11: Fish bone diagram for cause and effect analysis: broken rice from drying process

Table A1.11: Cause and effect analysis: broken rice from drying process according to Figure A1.5

Causes of broken rice	Controllable/Uncontrollable	Effect
1. Contaminate in rice	Uncontrollable due to rice from different sources	Major effect
2. Improper viscosity of coated paste	Controllable due to we can adjust viscosity of paste by changing ingredient ratios	Minor effect
3. High flow rate of hot air	Controllable due to we can adjust air flow rate at blowers	Minor effect
4. High temperature of hot air	Controllable due to we can adjust temperature of hot air	Major effect
5. Poor distribution of hot air	Controllable due to we can make distribution of hot air better, i.e. adding baffles	Minor effect
6. Speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Minor effect
7. Inaccurate temperature indicators in drying rooms	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
8. Inaccurate temperature indicators at gas burners	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
9. Non-suitable temperature in drying room	Controllable due to we can adjust drying temperature	Major effect
10. Poor distribution of coated rice	Controllable due to we can adjust hopper and conveyor speeds to improve distribution	Major effect
11. Insufficient heat generation at gas burner	Controllable due to we can select appropriate fuel at gas burner	Major effect
12. Long drying time	Controllable due to we can adjust some parameters to shorten drying time, i.e. air temperature, conveyor speed	Major effect
13. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
14. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

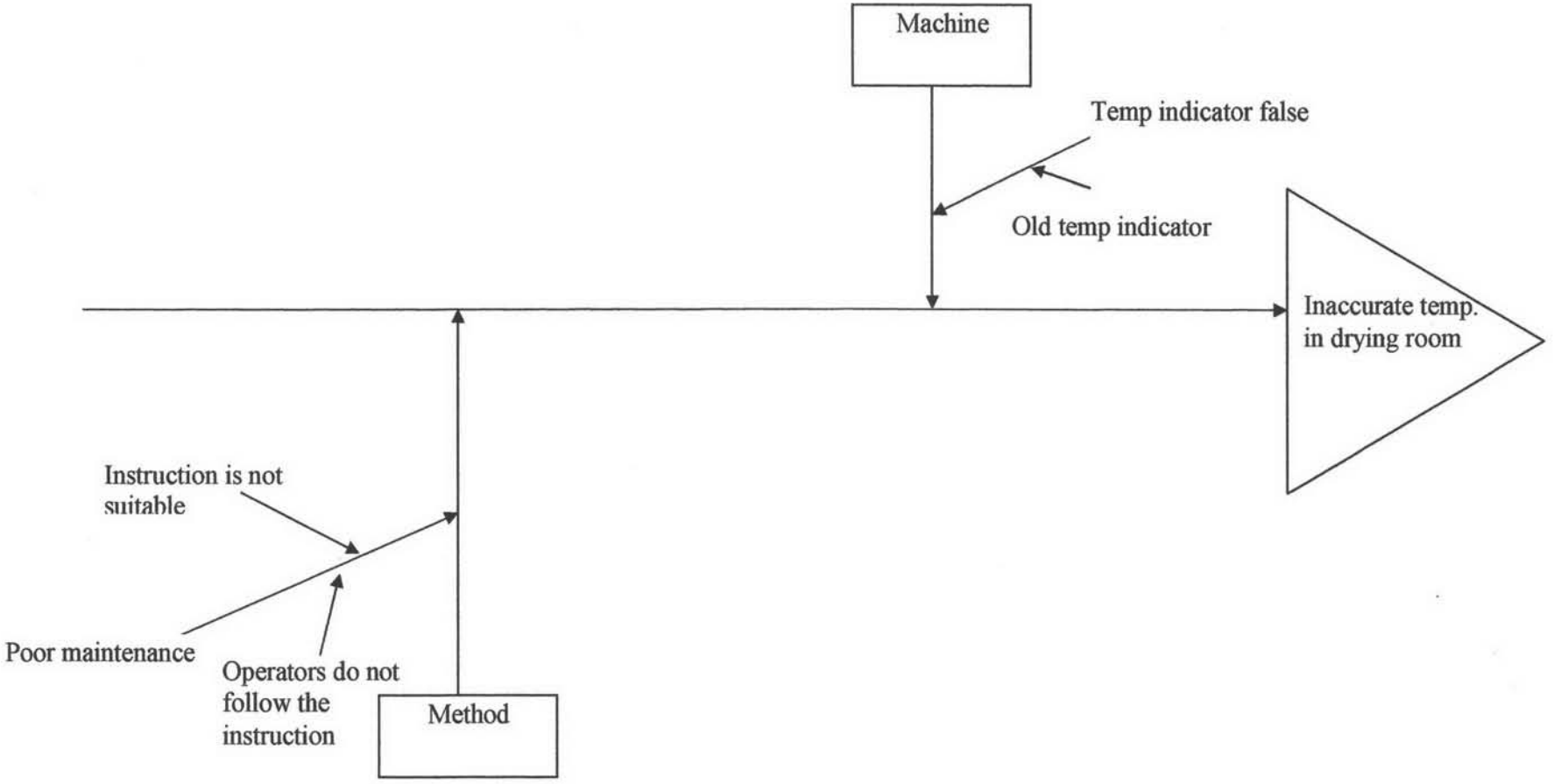


Figure A1.12: Fish bone diagram for cause and effect analysis: inaccurate temperature in drying room

Table A1.12: Cause and effect analysis for inaccurate temperature in drying room at drying process according to Figure A1.18

Causes of inaccurate temperature in drying room	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Instruction is not suitable	Controllable due to we can change work instruction to be more appropriate	Major effect
3. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

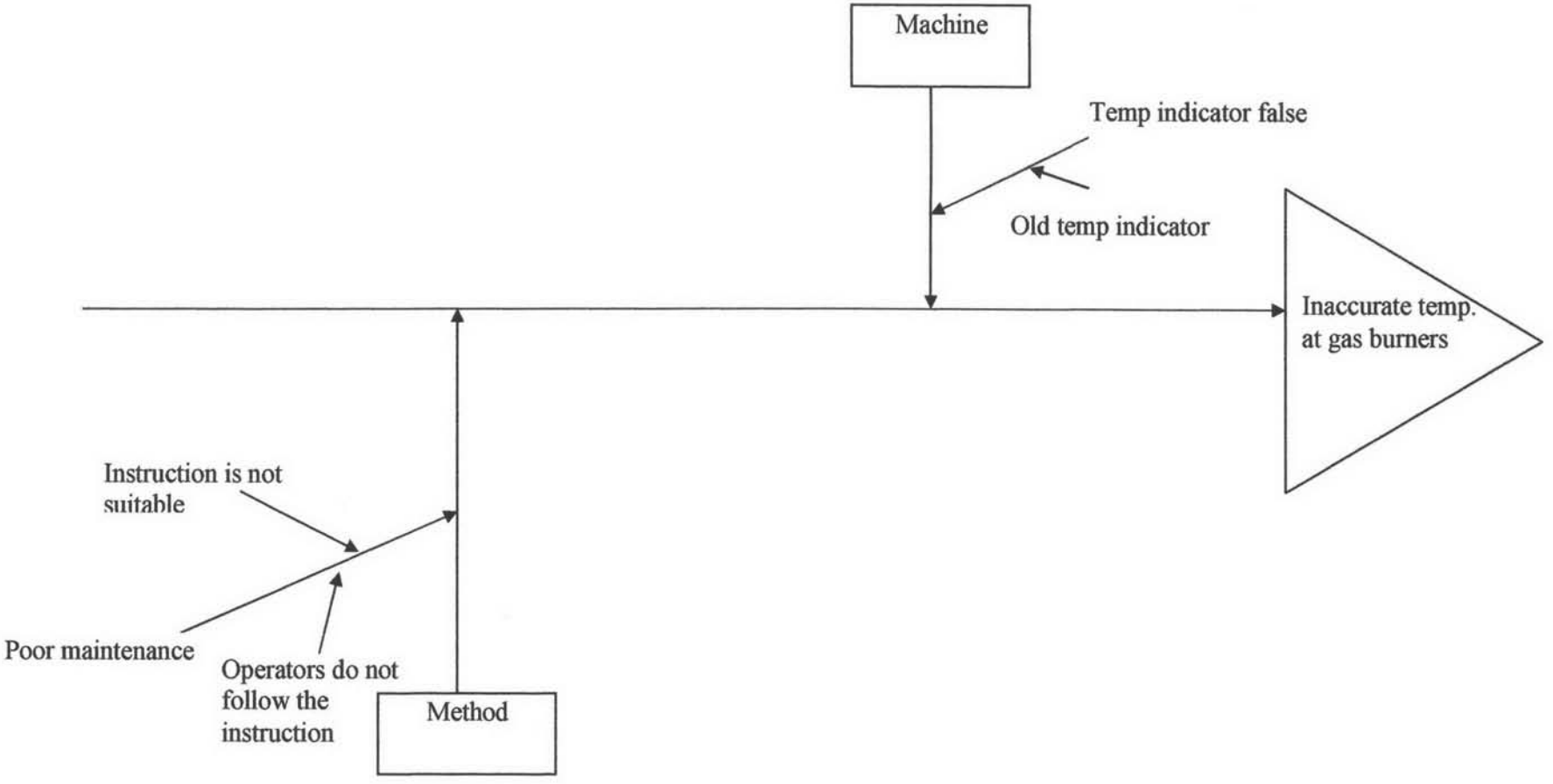


Figure A1.13: Fish bone diagram for cause and effect analysis: inaccurate temperature at gas burners

Table A1.13: Cause and effect analysis for inaccurate temperature at gas burners at drying process according to Figure A1.21

Causes of inaccurate temperature at gas burners	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Instruction is not suitable	Controllable due to we can change work instruction to be more appropriate	Major effect
3. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

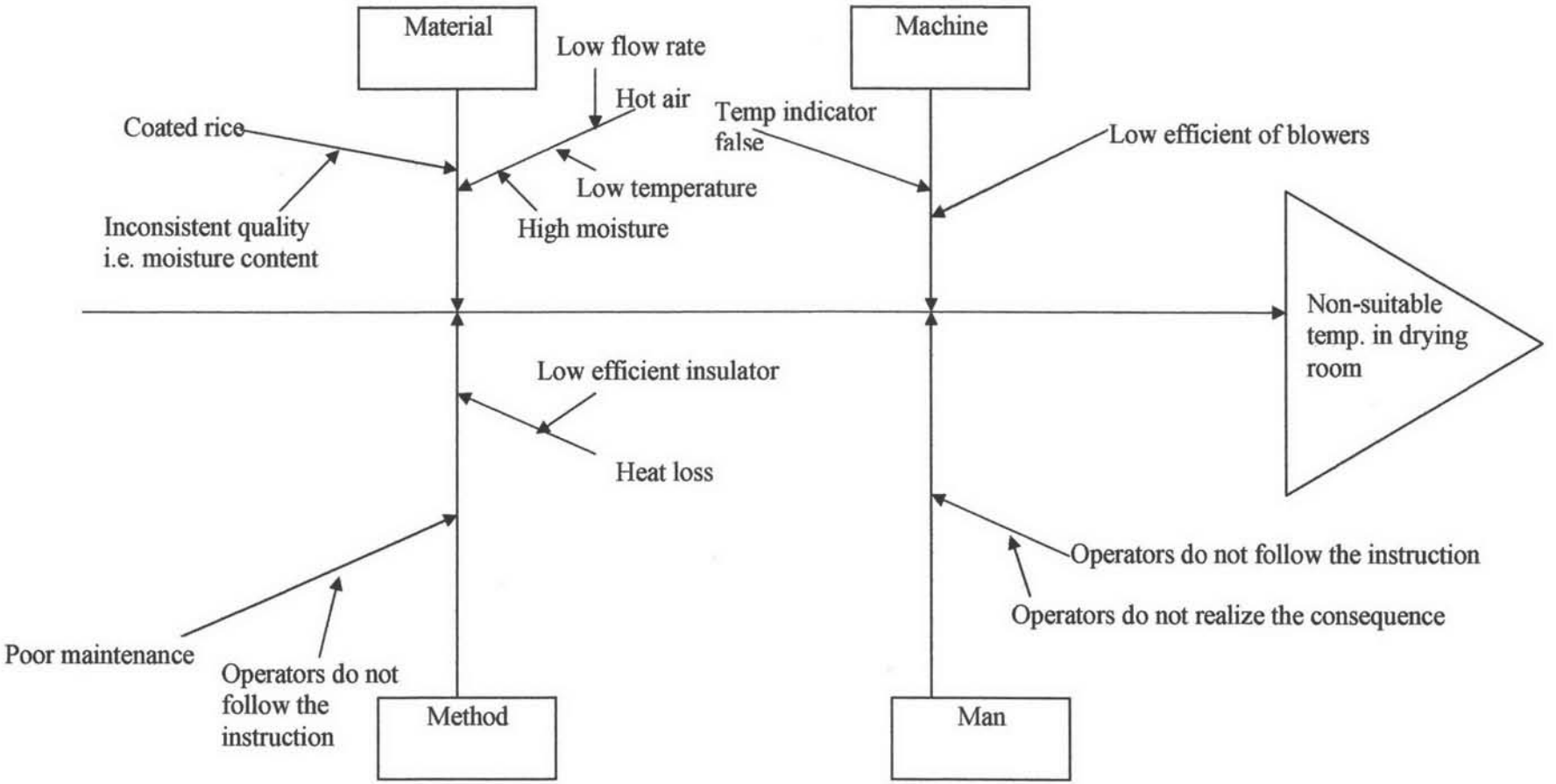


Figure A1.14: Fish bone diagram for cause and effect analysis: non-suitable temp in drying room

Table A1.14: Cause and effect analysis for non-suitable temperature in drying room at drying process according to Figure A1.17

Causes of non-suitable temperature in drying room	Controllable/ uncontrollable	Effect
1. Inconsistent quality of coated rice	Uncontrollable due to we have different types of paste used for coating	Major effect
2. Low temperature of hot air	Controllable due to we can increase hot air temperature by adjusting fuel feed	Major effect
3. Low flow rate of hot air	Controllable due to we can adjust flow rate of hot air at blowers	Major effect
4. High moisture content of hot air	Uncontrollable due to we do not have air moisture controlling equipment	Minor effect
5. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
6. Low efficient of blowers	Controllable due to we can replace or change some parts of blowers to make them more efficient	Major effect
7. Poor maintenance	Controllable due to we can set up maintenance plan	Major effect
8. Heat loss	Uncontrollable due to we do not have insulation	Minor effect
9. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

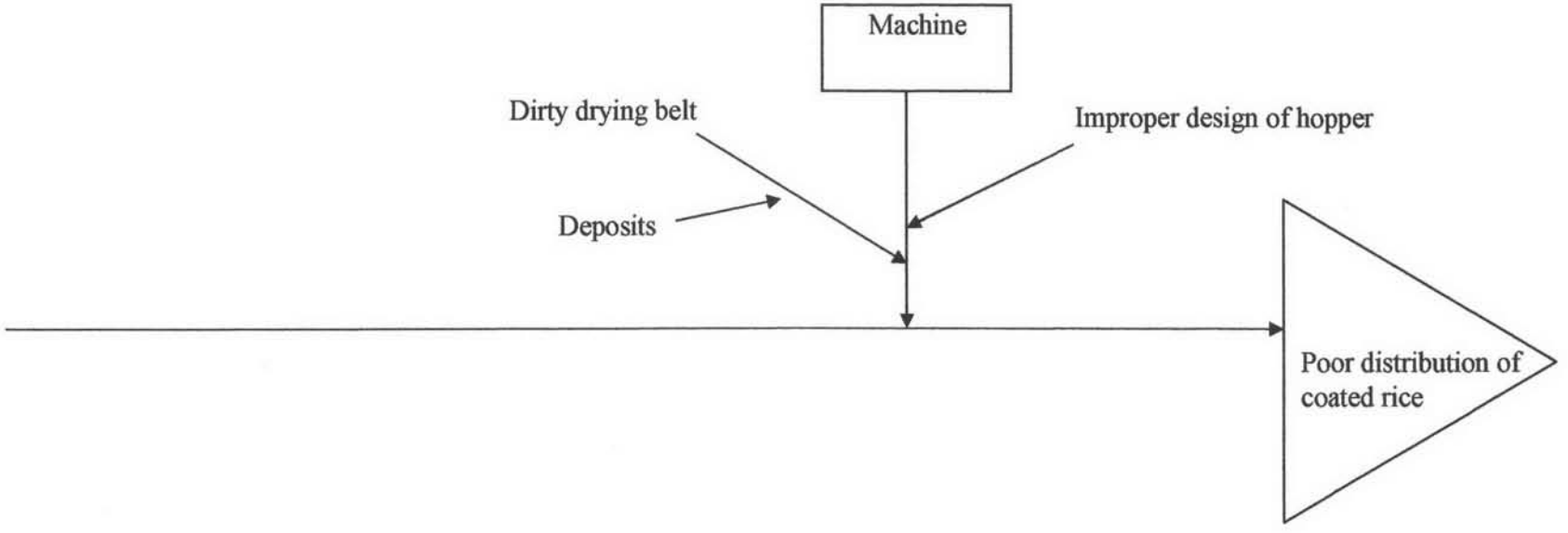


Figure A1.15: Fish bone diagram for cause and effect analysis: Poor distribution of coated rice

Table A1.15: Cause and effect analysis for poor distribution of coated rice at drying process according to Figure A1.19

Causes of poor distribution of coated rice	Controllable/Uncontrollable	Effect
1. Dirty drying belt	Uncontrollable due to we can not stop process to clean dirty belt when operation carries on	Minor effect
2. Improper design of hopper	Controllable due to we can adjust hopper space	Major effect

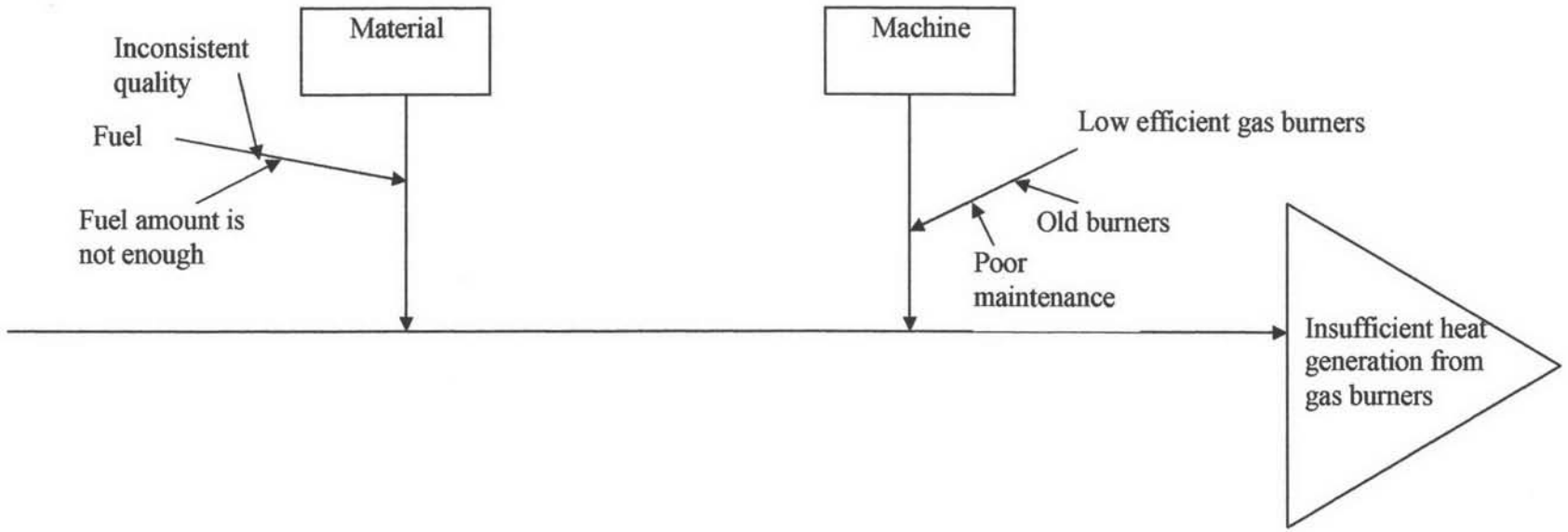


Figure A1.16: Fish bone diagram for cause and effect analysis: insufficient heat generation from gas burners

Table A1.16: Cause and effect analysis for insufficient heat generation from gas burners at drying process according to Figure A1.22

Causes of insufficient heat generation from gas burners	Controllable/Uncontrollable	Effect
1. Inconsistent quality of fuel	Controllable due to we can select appropriate type and quantity of fuel	Major effect
2. Fuel amount is not enough	Controllable due to we can set up work instruction to control fuel amount at gas burners	Major effect
3. Low efficient gas burners	Controllable due to we can set up maintenance plan and replace old parts of gas burners with more efficient ones	Major effect

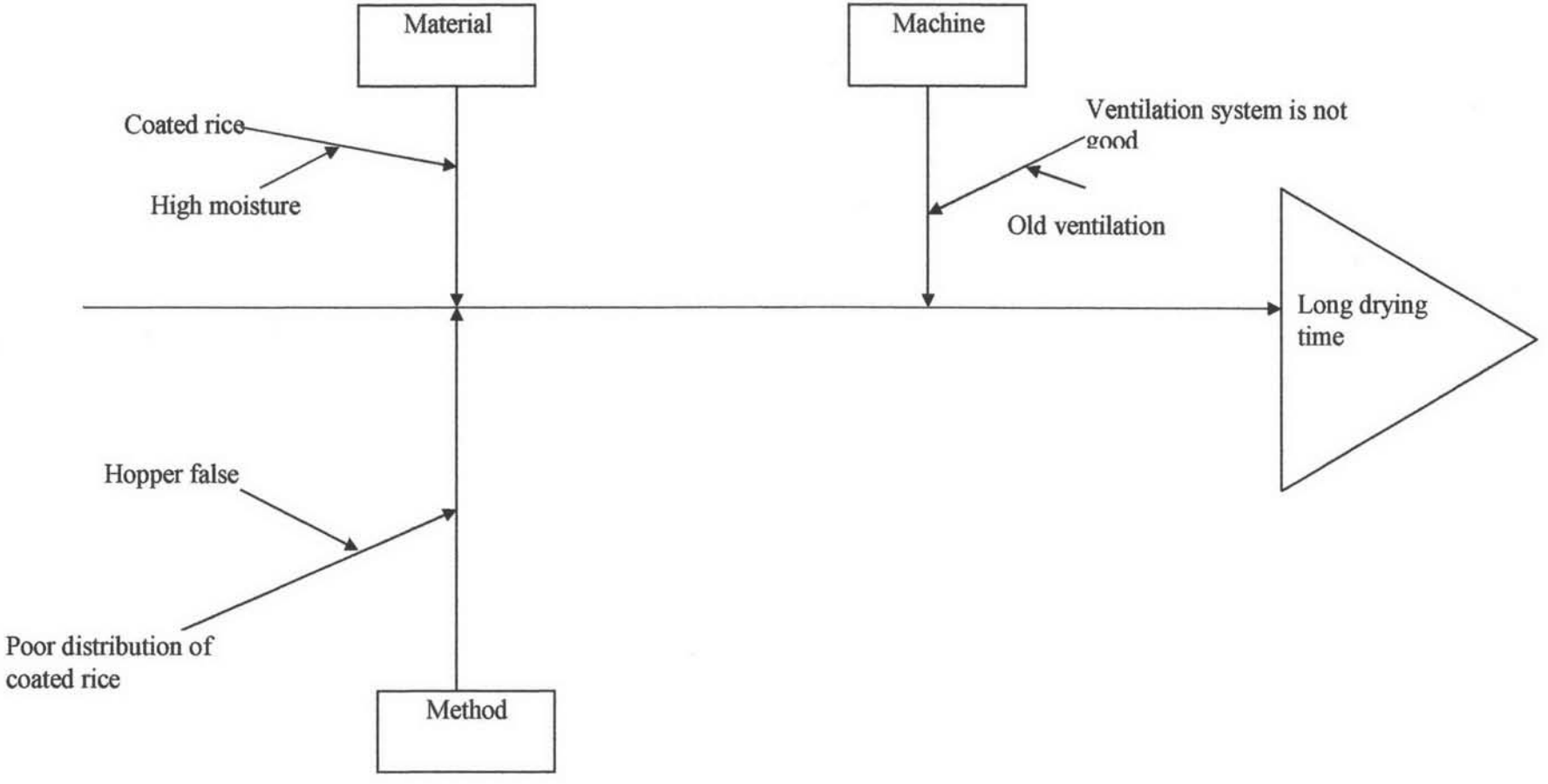


Figure A1.17: Fish bone diagram for cause and effect analysis: long drying time

Table A1.17: Cause and effect analysis for long drying time at drying process according to Figure A1.20

Causes of long drying time	Controllable/Uncontrollable	Effect
1. High moisture content in coated rice	Uncontrollable due to we use different types of paste in the process	Major effect
2. Ventilation system is not good	Controllable due to we can set up work instruction or preventive maintenance plan to improve ventilation system	Major effect
3. Poor distribution of coated rice	Controllable due to we can adjust hopper and conveyor speeds to improve distribution	Major effect

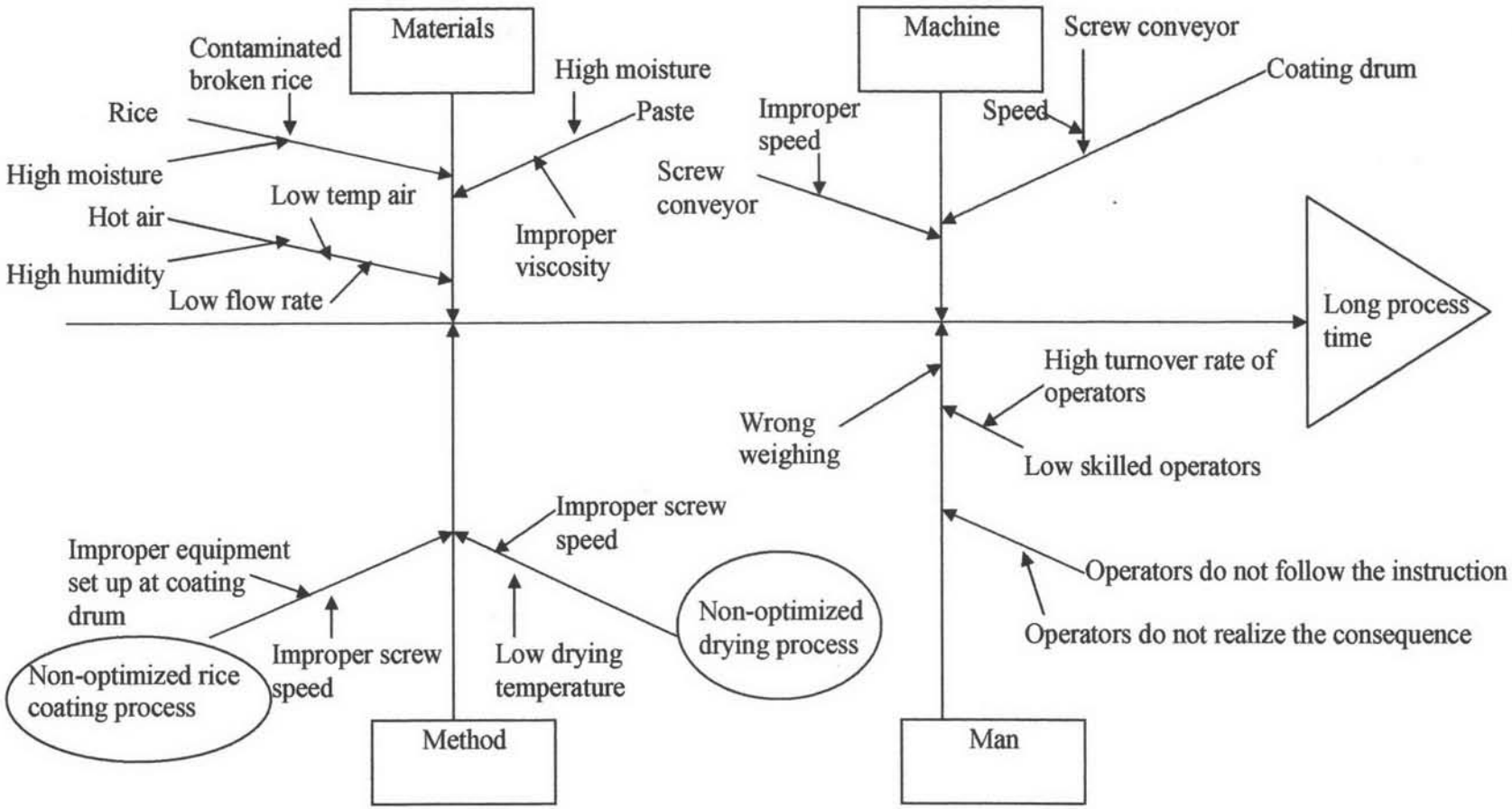


Figure A1.18: Fish bone diagram for cause and effect analysis: long process time from overall rice operational process

Table A1.18: Cause and effect analysis: overall rice operational process according to Figure A1.2

Causes of long process time	Controllable/Uncontrollable	Effect
1. Contaminated broken rice	Uncontrollable due to broken rice is certainly formed from the process	Minor effect
2. High moisture in rice	Uncontrollable due to rice is from different sources	Major effect
3. Low temperature of hot air	Controllable due to we can increase hot air temperature by adjusting fuel feed	Major effect
4. Low flow rate of hot air	Controllable due to we can adjust flow rate of hot air at blowers	Major effect
5. High humidity of hot air	Uncontrollable due to we do not have air moisture controlling equipment	Minor effect
6. High moisture in paste	Controllable due to we can adjust past ingredient ratios to lower its moisture content	Minor effect
7. Improper viscosity of paste	Controllable due to we can adjust past ingredient ratios	Minor effect
8. Improper speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Minor effect
9. Conveyor speed in coating drum	Controllable due to we can adjust speed of screw conveyor	Minor effect
10. Harsh transferring during loading	Controllable due to we can control loading process to be softer	Minor effect
11. Non-optimized rice coating process	Controllable due to we can adjust some parameters in coating process to be more optimize	Major effect
12. Non-optimized drying process	Controllable due to we can adjust drying time according to the particular feed	Major effect
13. Improper screw speed at drying process	Controllable due to we can adjust screw speed at drying process	Minor effect
14. Low drying temperature	Controllable due to we can adjust drying temperature	Major effect
15. High turnover rate of operators	Uncontrollable due to resignation of operators depends on them	Minor effect
16. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
17. Wrong weighing	Uncontrollable due to it depends on operators	Major effect
18. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

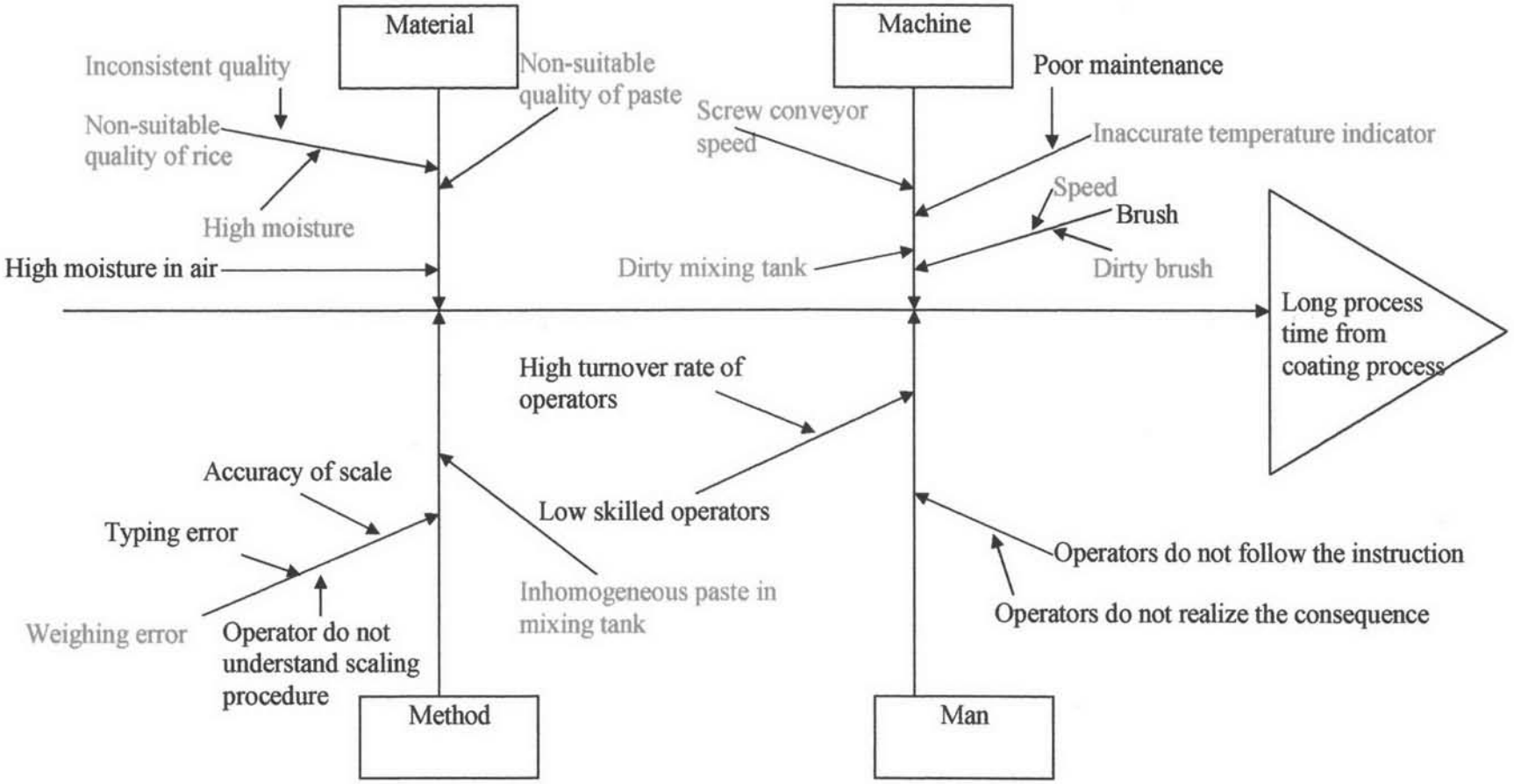


Figure A1.19: Fish bone diagram for cause and effect analysis: long process time from coating process

Table A1.19: Cause and effect analysis: long process time from coating process according to Figure A1.4

Causes of long process time	Controllable/Uncontrollable	Effect
1. Non-suitable quality of rice	Controllable due to we can improve quality of rice by appropriate working procedures and QC	Major effect
2. Non-suitable quality of paste	Controllable due to we can improve quality of paste by appropriate working procedures and QC	Major effect
3. High moisture in air	Uncontrollable due to we do not have equipment to control moisture in air	Minor effect
4. Speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Major effect
5. Dirty mixing tank	Controllable due to we can set up work instruction to reduce dirtiness at mixing tank	Major effect
6. Inaccurate temperature indicator	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
7. Dirty brush	Controllable due to we can set up work instruction to reduce dirtiness of brush	Major effect
8. Brush speed	Controllable due to we can control brush speed	Major effect
9. Weighing error	Uncontrollable due to it depends on operators	Major effect
10. Inhomogeneous paste in mixing tank	Controllable due to we can adjust speed and mixing time to make paste homogeneous	Major effect
11. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
12. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

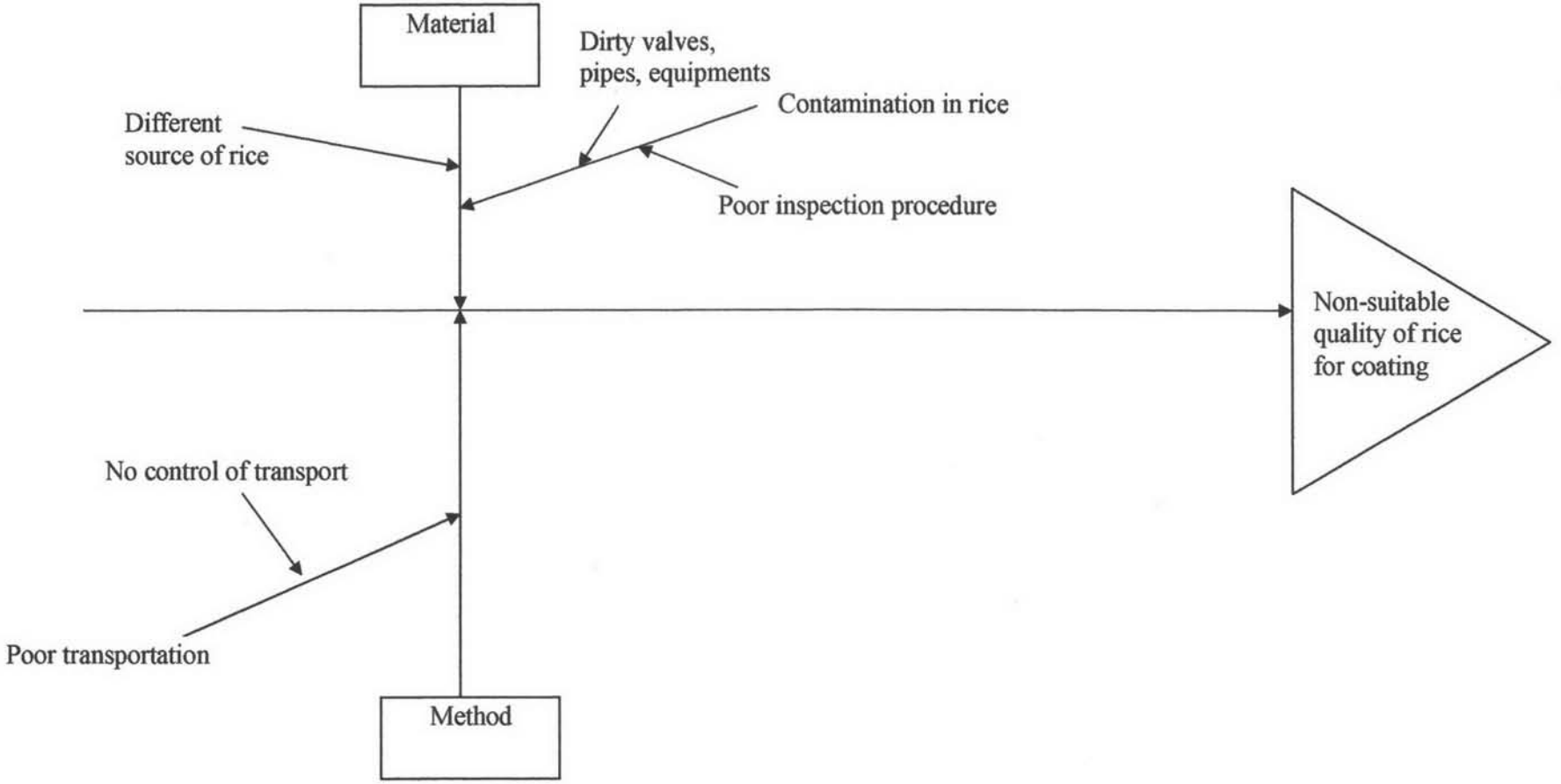


Figure A1.20: Fish bone diagram for cause and effect analysis: non-suitable quality of rice for coating

Table A1.20: Cause and effect analysis for non-suitable quality of rice for coating at coating process according to Figure A1.7

Causes of non-suitable quality of rice for coating	Controllable/Uncontrollable	Effect
1. Poor transportation	Uncontrollable due to its depends on the transportation from merchandises to the factory	Minor effect
2. Different sources of rice	Uncontrollable due to we cannot specify the source of rice	Minor effect
3. Contamination in rice due to poor inspection procedure	Controllable due to we can improve our inspection procedure	Major effect
4. Contamination in rice due to dirty valves, pipes and equipments	Controllable due to we can clean equipments to reduce contamination	Major effect

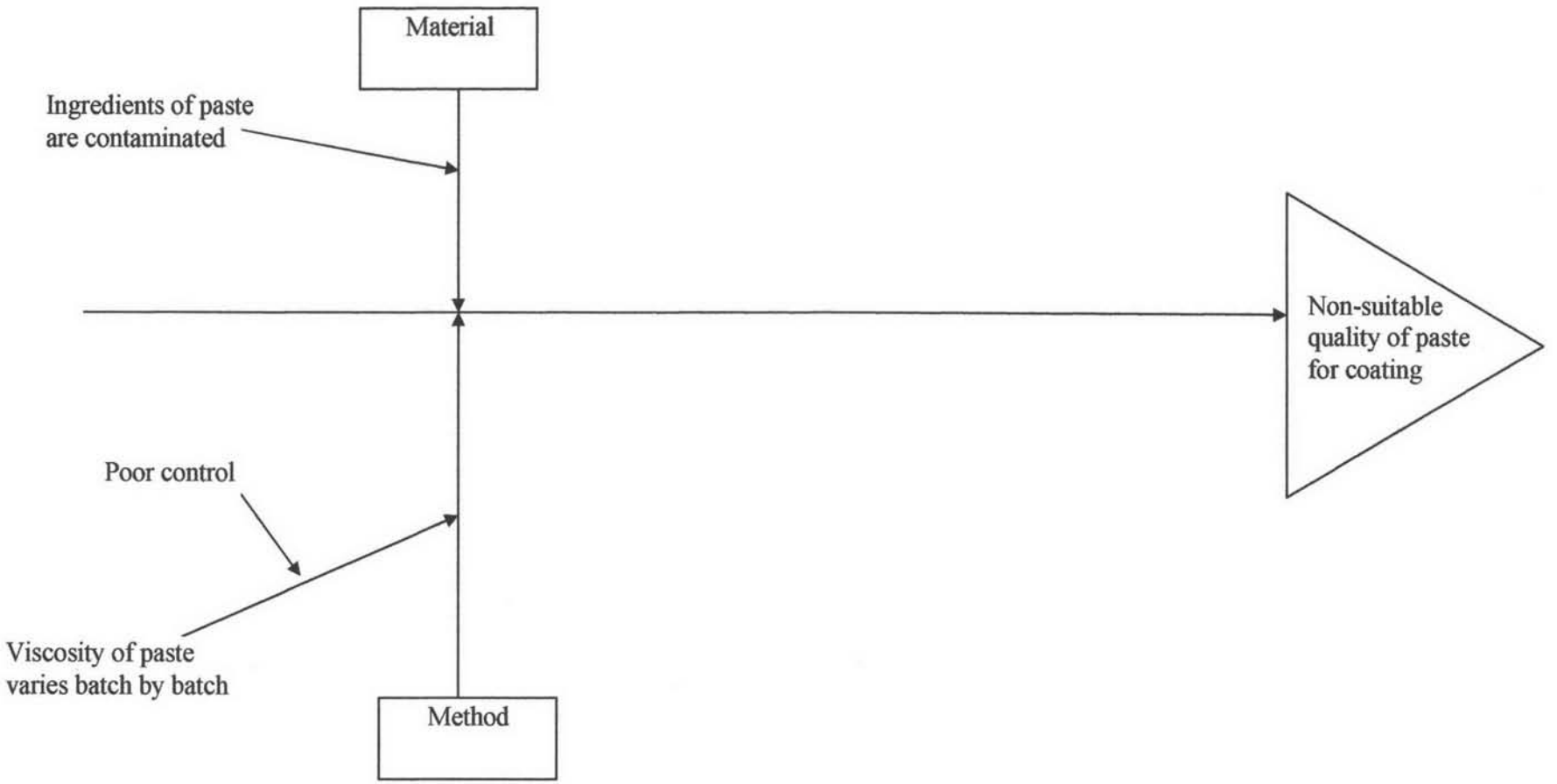


Figure A1.21: Fish bone diagram for cause and effect analysis: non-suitable quality of paste for coating

Table A1.21: Cause and effect analysis for non-suitable quality of paste for coating at coating process according to Figure A1.8

Causes of non-suitable quality of paste for coating	Controllable/Uncontrollable	Effect
1. Ingredient of paste are contaminated	Controllable due to we can issue appropriate work instruction to avoid contamination	Major effect
2. Viscosity of paste varies batch by batch	Uncontrollable due to we used several types of paste in the process	Major effect

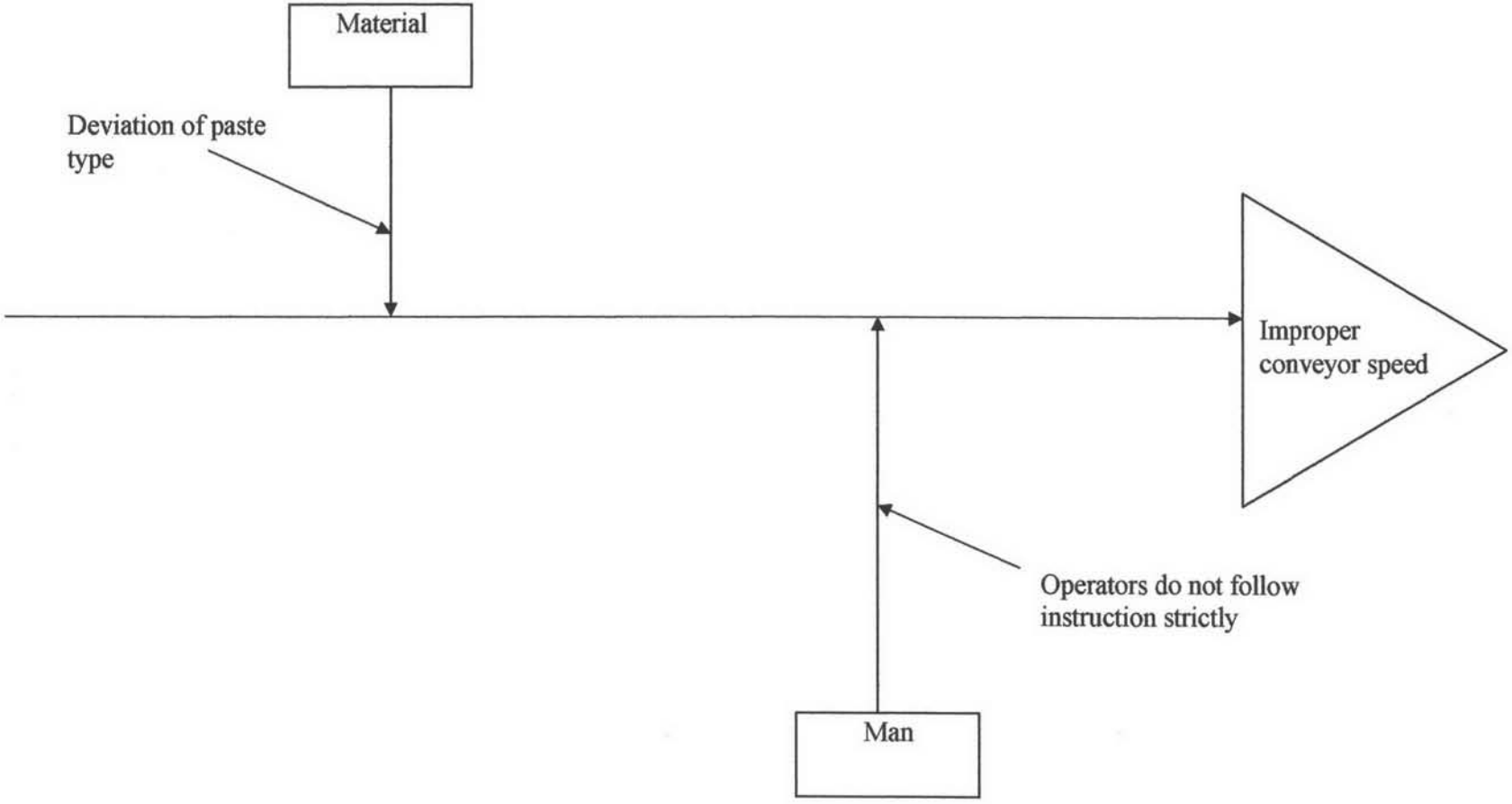


Figure A1.22: Fish bone diagram for cause and effect analysis: Improper conveyor speed

Table A1.22: Cause and effect analysis for improper conveyor speed at coating process according to Figure A1.16

Causes of improper conveyor speed	Controllable/uncontrollable	Effect
1. Deviation of paste type	Uncontrollable due to several types of paste are used at the factory	Major effect
2. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

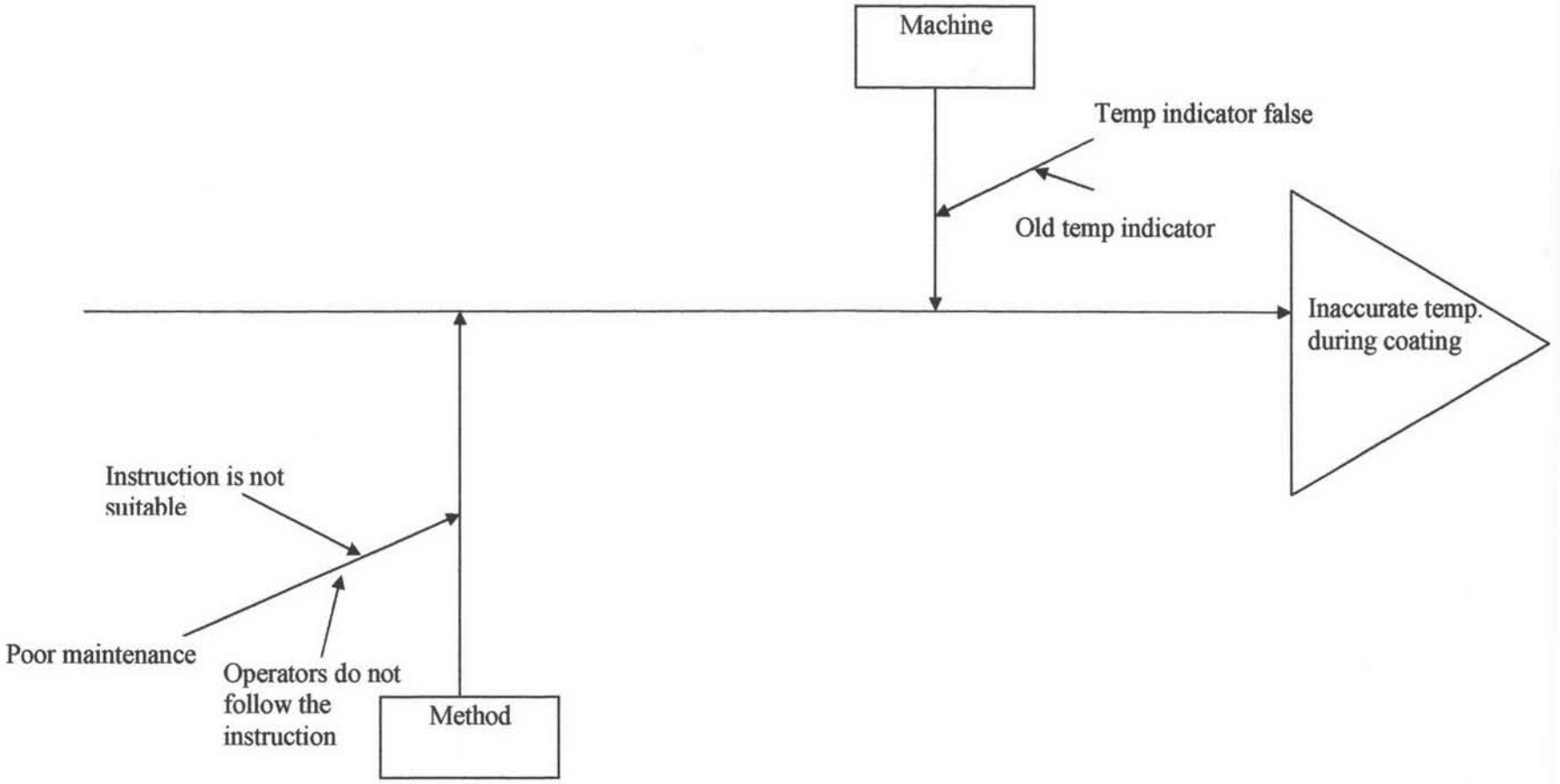


Figure A1.23: Fish bone diagram for cause and effect analysis: inaccurate temperature during coating

Table A1.23: Cause and effect analysis for inaccurate temperature during coating at coating process according to Figure A1.10

Causes of inaccurate temperature during coating	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Poor maintenance	Controllable due to we can set up preventive maintenance plan	Major effect

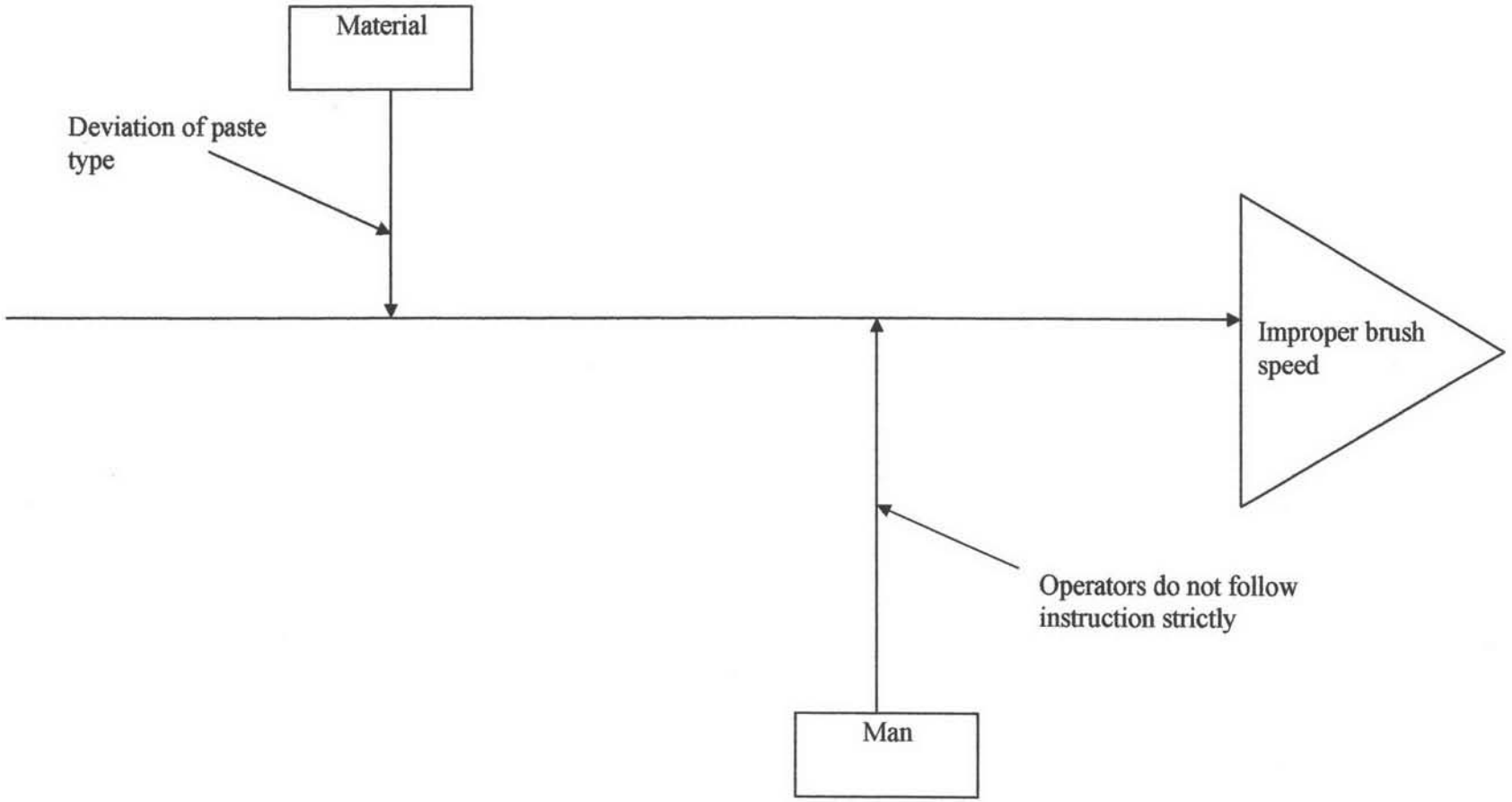


Figure A1.24: Fish bone diagram for cause and effect analysis: Improper brush speed

Table A1.24: Cause and effect analysis for improper brush speed at coating process according to Figure A1.15

Causes of improper brush speed	Controllable/Uncontrollable	Effect
1. Deviation of paste type	Uncontrollable due to several types of paste are used at the factory	Major effect
2. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

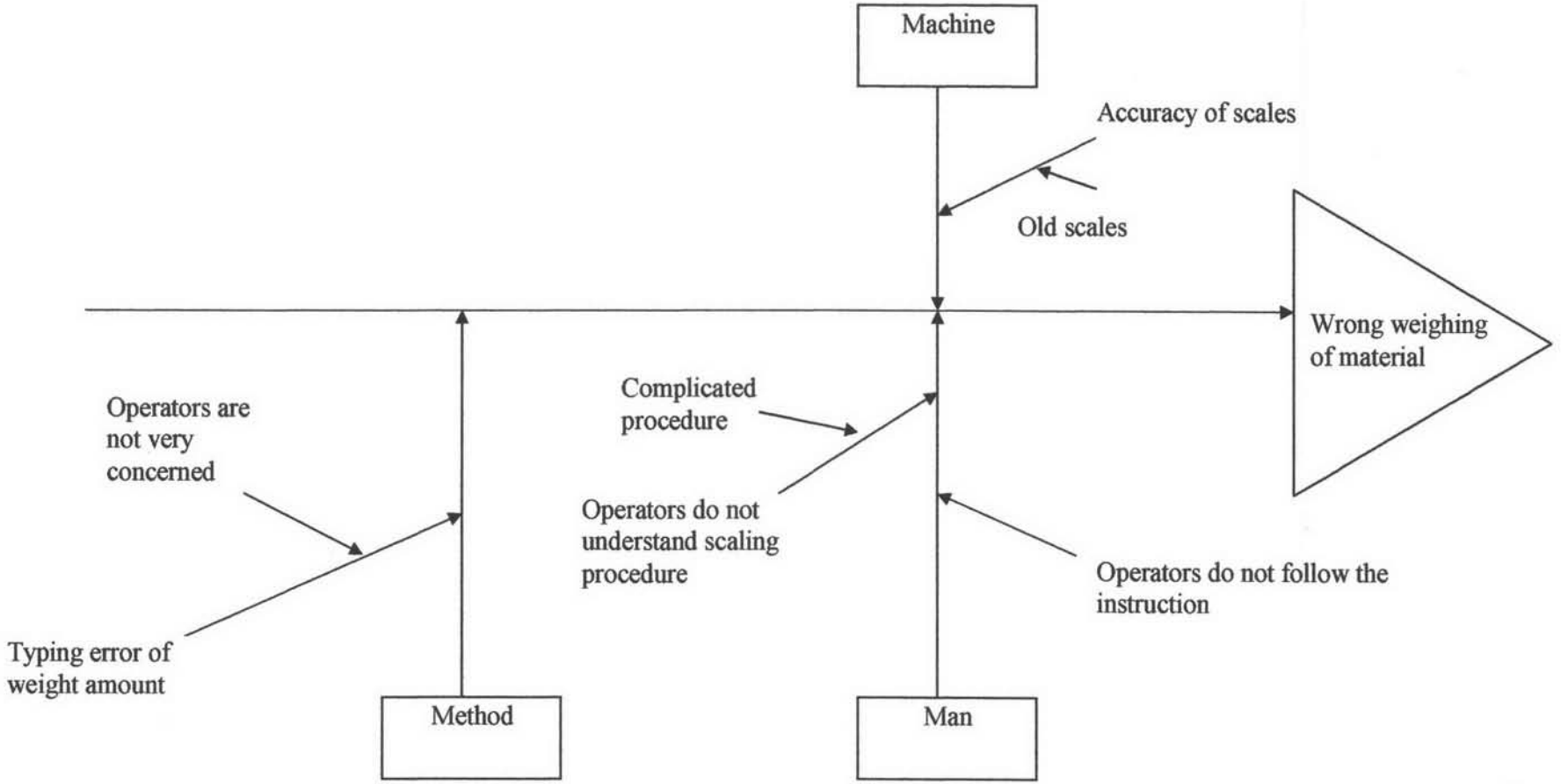


Figure A1.25: Fish bone diagram for cause and effect analysis: wrong weighing of materials

Table A1.25: Cause and effect analysis for wrong weighing of material at coating process according to Figure A1.11

Causes of wrong weighing of material	Controllable/Uncontrollable	Effect
1. Accuracy of scales	Controllable due tow e can set up calibration procedure to improve accuracy of scales	Major effect
2. Typing error of weight amount	Uncontrollable due to it depends on operators	Major effect
3. Operators do not understand scaling procedure	Controllable due to we can set up training to ensure that operators understand the scaling procedure	Major effect
4. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

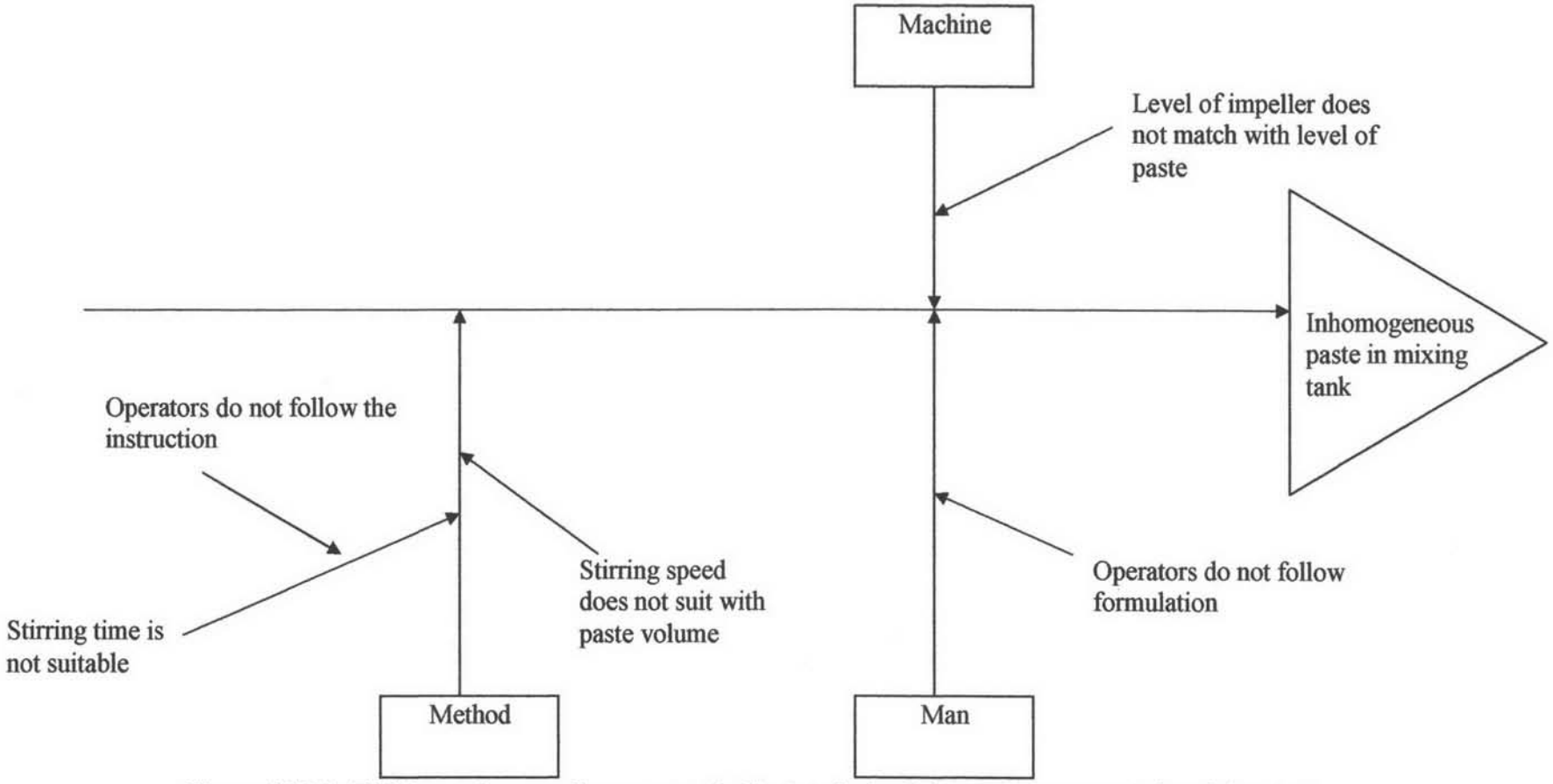


Figure A1.26: Fish bone diagram for cause and effect analysis: Inhomogeneous paste in mixing tank

Table A1.26: Cause and effect analysis for inhomogeneous paste in mixing tank at coating process according to Figure A1.14

Causes of inhomogeneous paste in mixing tank	Controllable/Uncontrollable	Effect
1. Level of impeller does not match with level of paste	Controllable due to we can adjust level of impeller in the mixing tanks	Major effect
2. Stirring time is not suitable	Controllable due to we can adjust stirring time easily	Major effect
3. Stirring speed does not suit with paste volume	Controllable due to we can adjust stirring speed easily	Major effect
4. Operators do not follow formulation	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

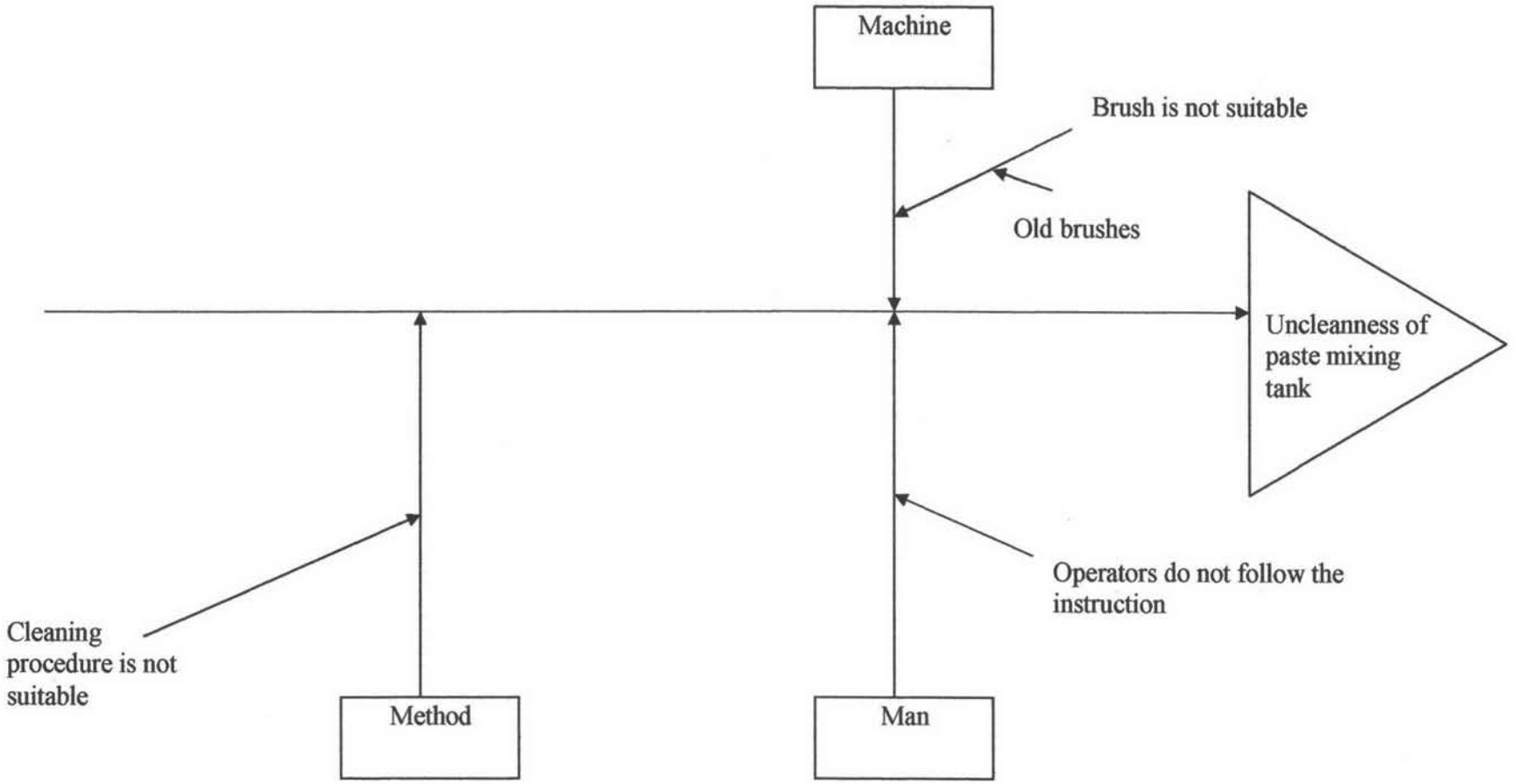


Figure A1.27: Fish bone diagram for cause and effect analysis: uncleanness of paste mixing tank

Table A1.27: Cause and effect analysis for uncleanness of paste mixing tank at coating process according to Figure A1.12

Causes of uncleanness of paste mixing tank	Controllable/Uncontrollable	Effect
1. Brush is not suitable	Controllable due to we can change brush	Major effect
2. Cleaning procedure is not suitable	Controllable due to we can set up new work instruction for cleaning procedure	Major effect
3. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

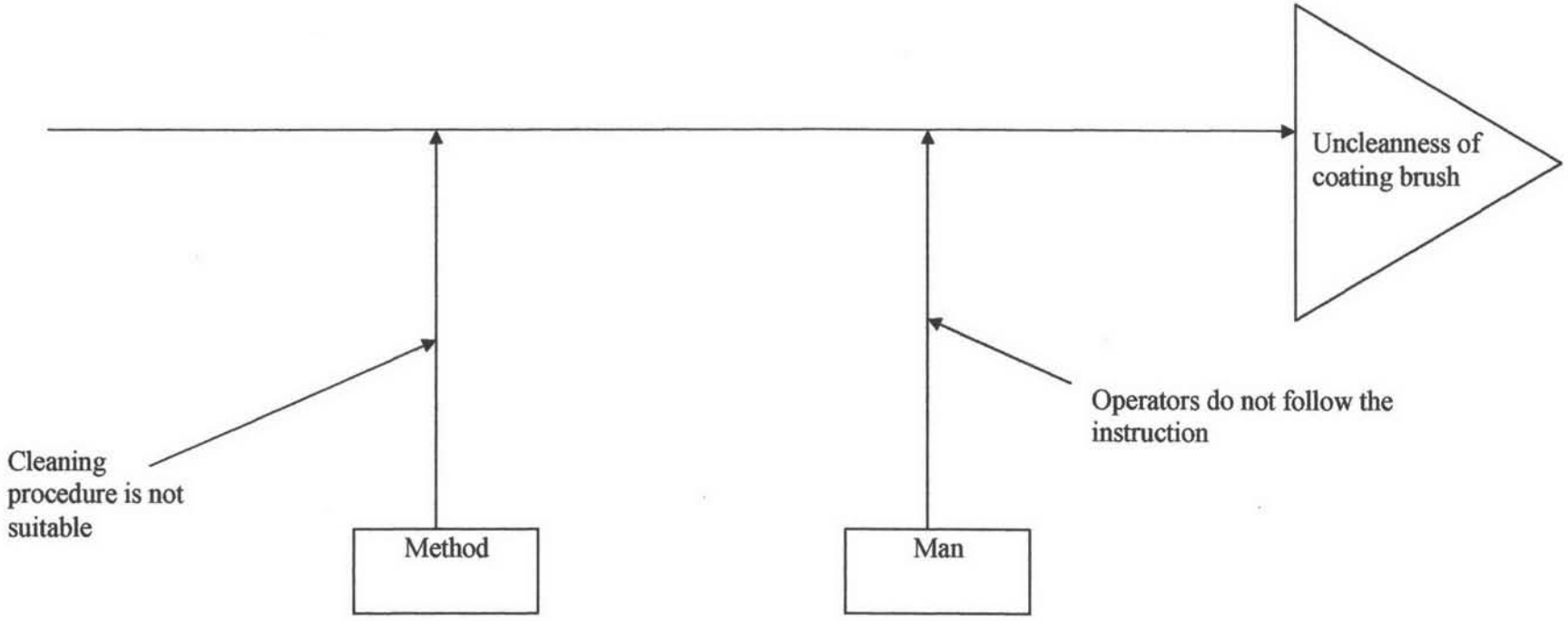


Figure A1.28: Fish bone diagram for cause and effect analysis: uncleanness of coating brush

Table A1.28: Cause and effect analysis for uncleanness of coating brush at coating process according to Figure A1.13

Causes of uncleanness of coating brush	Controllable/Uncontrollable	Effect
1. Cleaning procedure is not suitable	Controllable due to we can set up new work instruction for cleaning procedure	Major effect
2. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

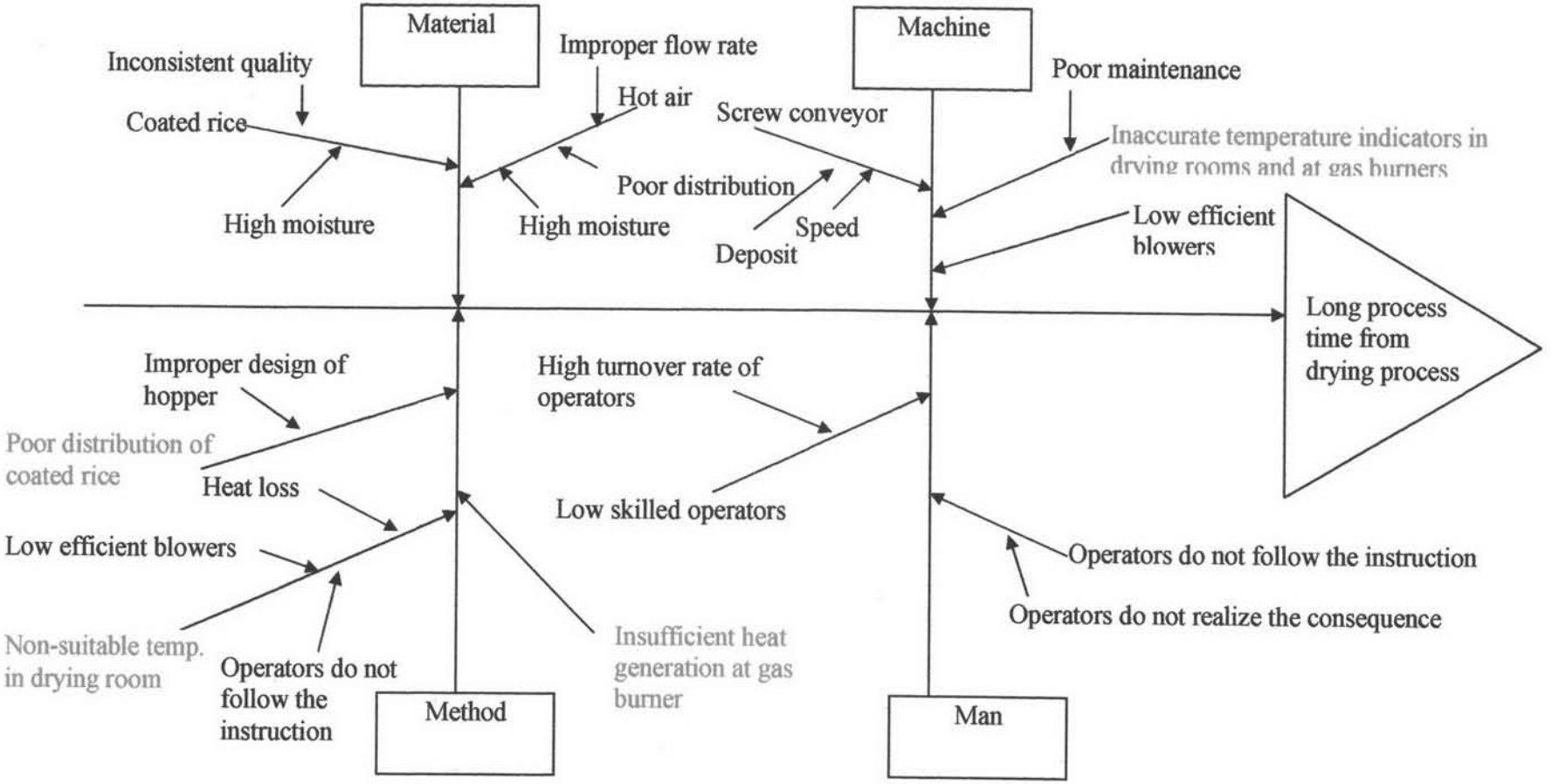


Figure A1.29: Fish bone diagram for cause and effect analysis: long process time from drying process

Table A1.29: Cause and effect analysis: long process time from drying process according to Figure A1.6

Causes of long process time	Controllable/Uncontrollable	Effect
1. Inconsistent quality of coated rice	Uncontrollable due to we have different types of paste used in the process	Major effect
2. High moisture in coated rice	Uncontrollable due to we have different types of paste used in the process	Major effect
3. Improper flow rate of hot air	Controllable due to we can adjust flow rate of hot air	Minor effect
4. High moisture of hot air	Uncontrollable due to we do not have equipment to control moisture in air	Minor effect
5. Poor distribution of hot air	Controllable due to we can adjust flow rate of hot air	Major effect
6. Speed of screw conveyor	Controllable due to we can adjust speed of screw conveyor	Minor effect
7. Deposits on screw conveyor	Controllable due to we can set up work instruction for cleaning procedure	Minor effect
8. Inaccurate temperature indicators in drying rooms	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
9. Inaccurate temperature indicators at gas burners	Controllable due to we can make temperature indicators more accurate, i.e. by calibration and regularly check	Major effect
10. Low efficient blowers	Controllable due to we can replace or change some parts of blowers to make them more efficient	Major effect
11. Poor distribution of coated rice	Controllable due to we can adjust hopper and conveyor speed	Major effect
12. Non-suitable temperature in drying room	Controllable due to we can adjust drying temperature	Major effect
13. Insufficient heat generation at gas burner	Controllable due to we can adjust fuel feed and quality	Major effect
14. Low skilled operators	Controllable due to we can enhance operators' skills by training provision	Minor effect
15. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

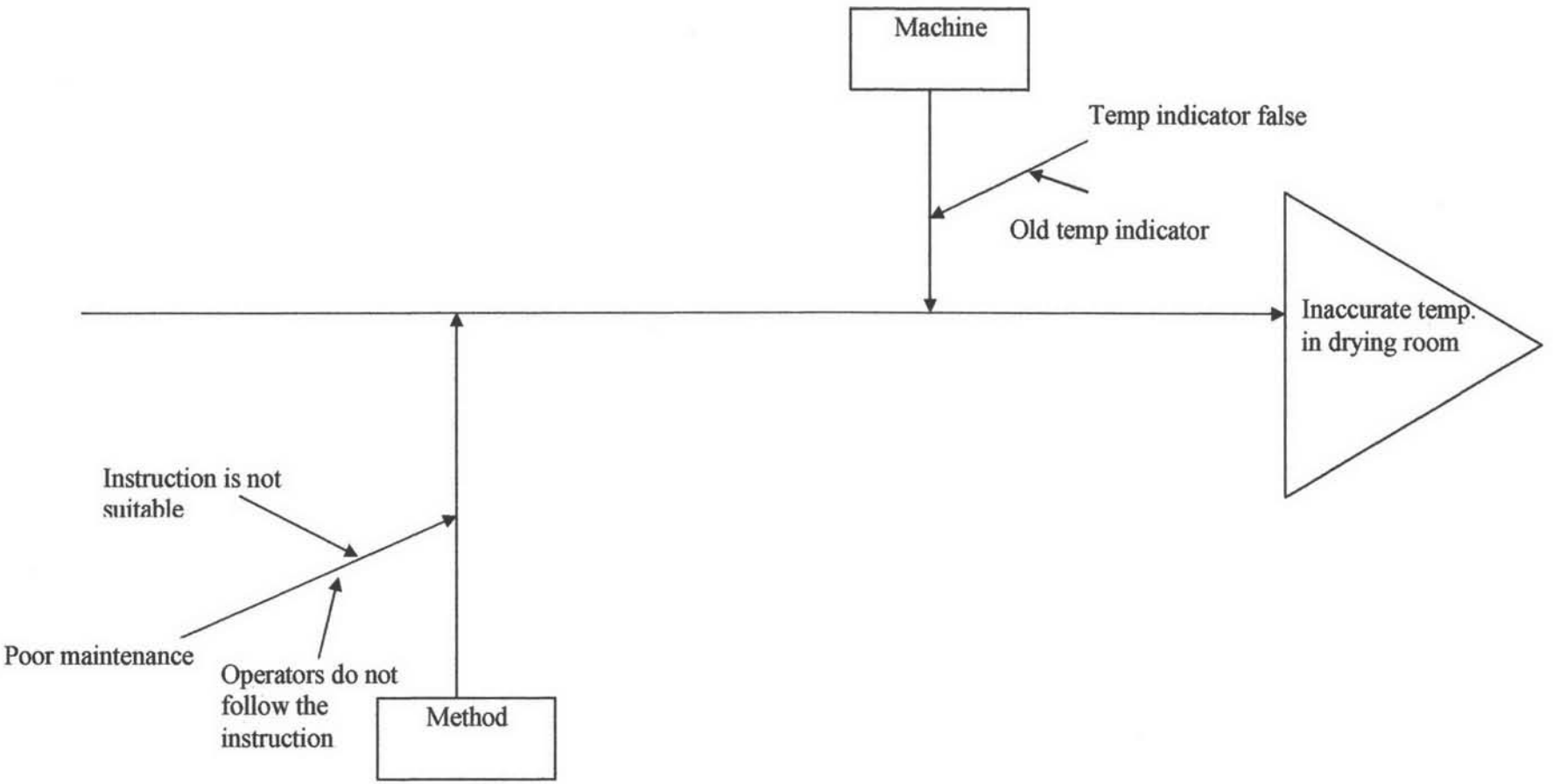


Figure A1.30: Fish bone diagram for cause and effect analysis: inaccurate temperature in drying room

Table A1.30: Cause and effect analysis for inaccurate temperature in drying room at drying process according to Figure A1.18

Causes of inaccurate temperature in drying room	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Instruction is not suitable	Controllable due to we can change work instruction to be more appropriate	Major effect
3. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

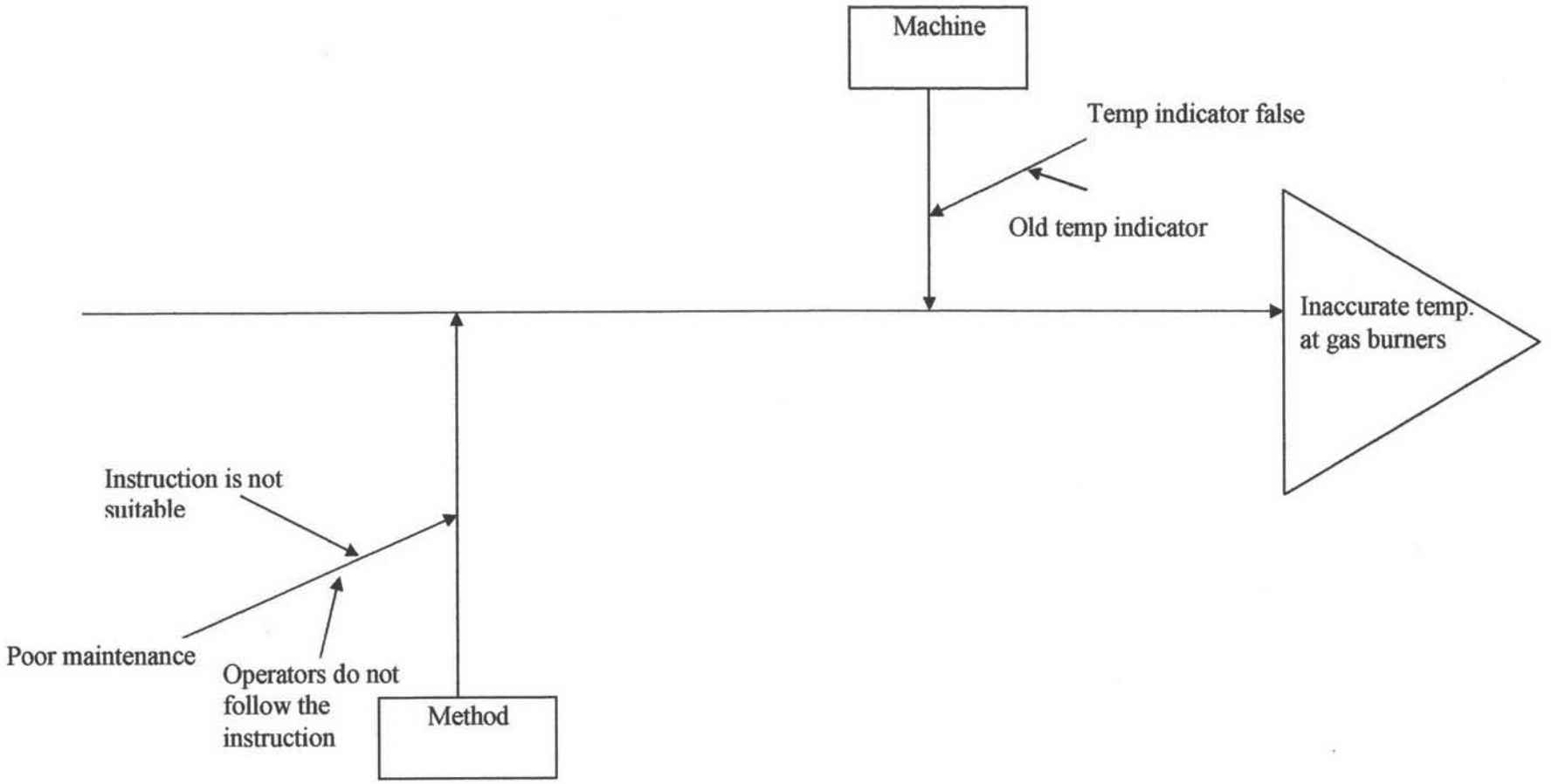


Figure A1.31: Fish bone diagram for cause and effect analysis: inaccurate temperature at gas burners

Table A1.31: Cause and effect analysis for inaccurate temperature at gas burners at drying process according to Figure A1.21

Causes of inaccurate temperature at gas burners	Controllable/Uncontrollable	Effect
1. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
2. Instruction is not suitable	Controllable due to we can change work instruction to be more appropriate	Major effect
3. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

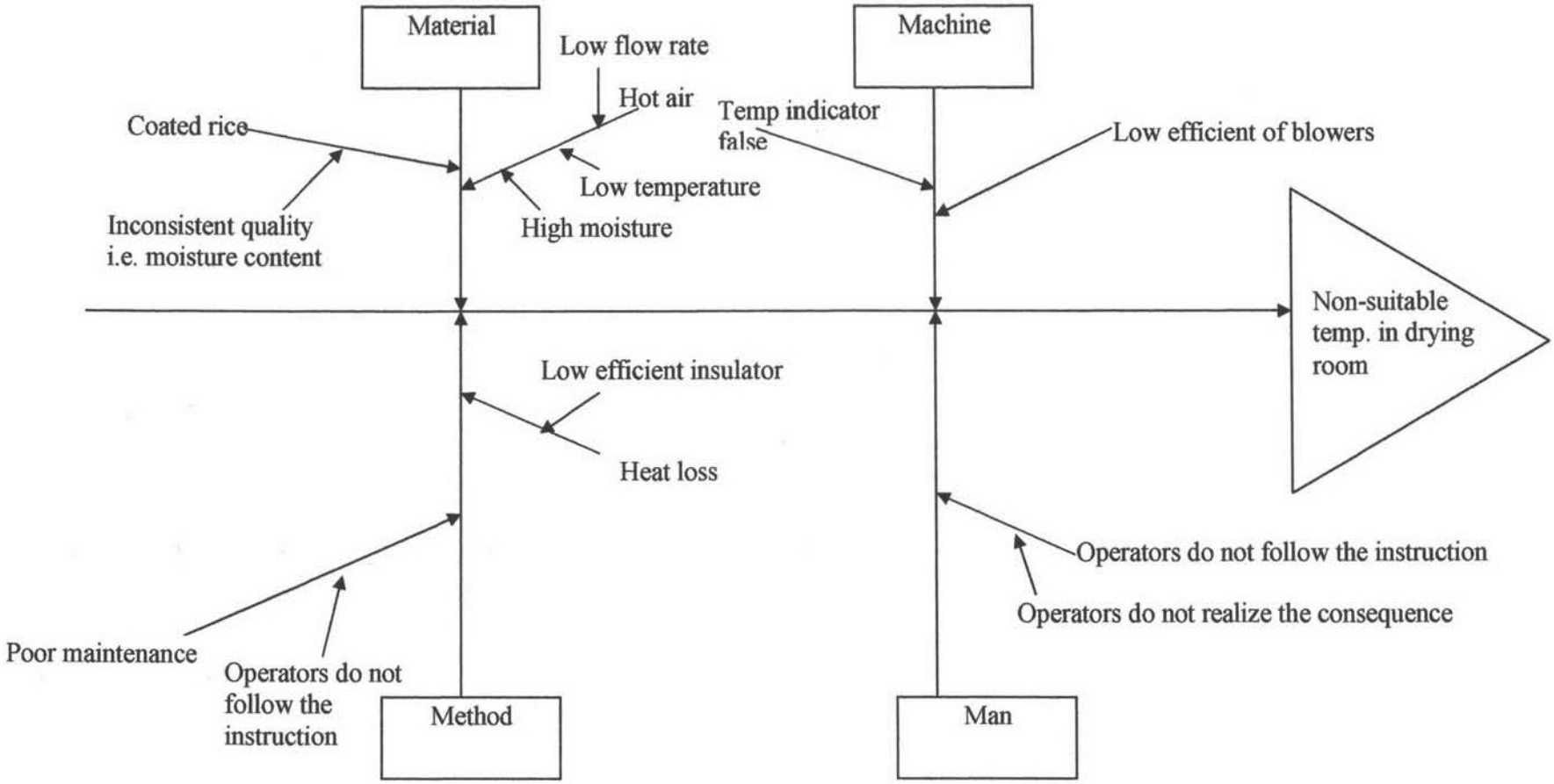


Figure A1.32: Fish bone diagram for cause and effect analysis: non-suitable temp in drying room

Table A1.32: Cause and effect analysis for non-suitable temperature in drying room at drying process according to Figure A1.17

Causes of non-suitable temperature in drying room	Controllable/ uncontrollable	Effect
1. Inconsistent quality of coated rice	Uncontrollable due to we have different types of paste used for coating	Major effect
2. Low temperature of hot air	Controllable due to we can increase hot air temperature by adjusting fuel feed	Major effect
3. Low flow rate of hot air	Controllable due to we can adjust flow rate of hot air at blowers	Major effect
4. High moisture content of hot air	Uncontrollable due to we do not have air moisture controlling equipment	Minor effect
5. Temperature indicator false	Controllable due to we can set up preventive maintenance plan to regularly check temperature indicator	Major effect
6. Low efficient of blowers	Controllable due to we can replace or change some parts of blowers to make them more efficient	Major effect
7. Poor maintenance	Controllable due to we can set up maintenance plan	Major effect
8. Heat loss	Uncontrollable due to we do not have insulation	Minor effect
9. Operators do not follow the instruction	Controllable due to we can set up training to make operators more realize on the work instruction following	Major effect

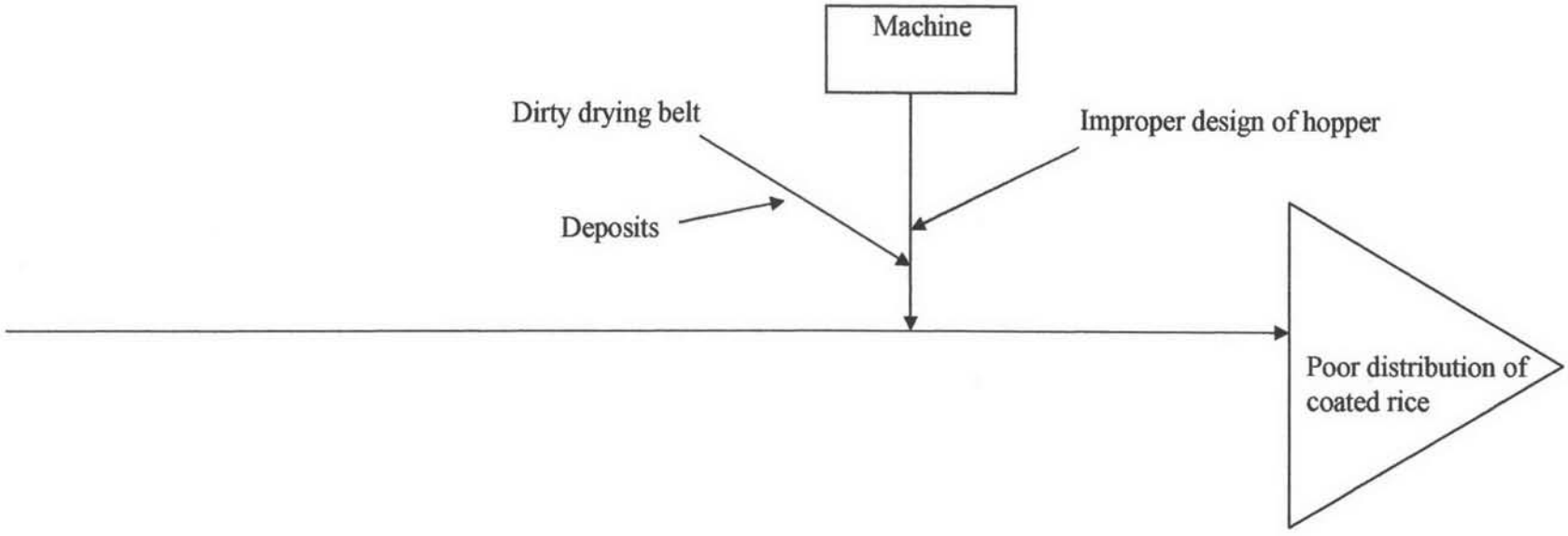


Figure A1.33: Fish bone diagram for cause and effect analysis: Poor distribution of coated rice

Table A1.33: Cause and effect analysis for poor distribution of coated rice at drying process according to Figure A1.19

Causes of poor distribution of coated rice	Controllable/Uncontrollable	Effect
1. Dirty drying belt	Uncontrollable due to we can not stop process to clean dirty belt when operation carries on	Minor effect
2. Improper design of hopper	Controllable due to we can adjust hopper space	Major effect

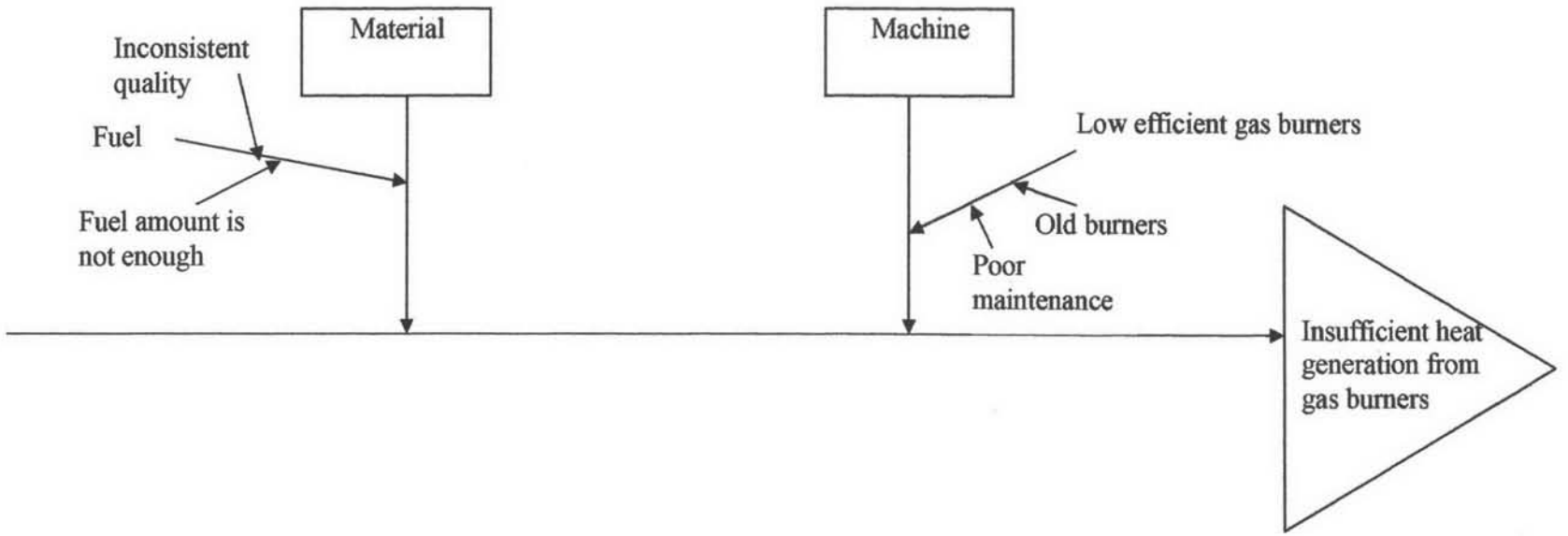


Figure A1.34: Fish bone diagram for cause and effect analysis: insufficient heat generation from gas burners

Table A1.34: Cause and effect analysis for insufficient heat generation from gas burners at drying process according to Figure A1.22

Causes of insufficient heat generation from gas burners	Controllable/Uncontrollable	Effect
1. Inconsistent quality of fuel	Controllable due to we can select appropriate type and quantity of fuel	Major effect
2. Fuel amount is not enough	Controllable due to we can set up work instruction to control fuel amount at gas burners	Major effect
3. Low efficient gas burners	Controllable due to we can set up maintenance plan and replace old parts of gas burners with more efficient ones	Major effect

Appendix II

Process FMEA (Failure Mode and Effect Analysis)

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected			
											S	O	D	RPN
Coating	Inconsistent quality of rice (i.e.moisture)	Deviation of coating quality	5	Different sources, Poor transportation	6	No inspection and control	8	240	Set up work instruction for quality control	QC (6/6/07)				
	Contaminates in rice	Machine damage	8	Poor inspection procedure	6	Manual inspection	7	336	Set up work instruction	QC (11/6/07)				
	Viscosity of paste varies batch by batch	Deviation of coating quality	5	Poor control procedure for paste preparation	8	Loose control	7	280	Set up work instruction	QC (11/6/07)				
	Uncontrolled moisture in the air	Deviation of coating quality	5	Too much raining can affect moisture in air	4	No control	8	160	Develop system that can control air moisture	Process Engineer (5/6/07)				
	Inaccurate temp. during coating	Deviation of coating quality	5	Poor maintenance, temp. indicator false	5	Periodical check of temp. indicator	4	100	Set up work instruction for calibration	Maintenance (15/6/07)				
	Solidification of paste	Paste plug in tubes coating process shut down	7	Poor temp control, heat loss during transporting	4	Control only paste mixing tank	7	196	Build insulation around paste line, set up work instruction for temp. control	Production Eng. (19/6/07)				

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected			
											S	O	D	RPN
Coating	Contaminates of coated rice	Off-spec products	7	Cleanliness of valves, pipes, equipments	3	Visual inspection	7	147	No action	-				
	Wrong weighting of raw materials	Off-spec products/ products need quality adjustment	7	Typing error of weigth amount	4	Work instruction	3	84	Set up training for operators	Production Eng. (7/6/07)				
	Wrong weighting of raw materials	Off-spec products/ products need quality adjustment	7	Operators do not understand scaling procedure	5	No control	3	105	Set up training for operators	Production Eng. (7/6/07)				
	Wrong weighting of raw materials	Off-spec products/ products need quality adjustment	7	Accuracy of scale	3	Calibration	4	84	No action	-				
	Uncleanness of paste mixing tank	Deviation of coating quality	5	Cleaning procedure is not suitable	4	Visual inspection	7	140	Set up schedule and procedure for cleaning	Process Eng. (12/6/07)				
	Uncleanness of paste mixing tank	Deviation of coating quality	5	Brush for cleaning is not suitable	6	Visual Inspection	7	210	Modify equipment to match with cleaning	Process Eng. (5/6/07)				
	Uncleanness of coating brush	Next coating is impossible	5	Cleaning procedure is not suitable	5	Visual Inspection	7	175	Modify caoting brush system	Process Eng. (12/6/07)				

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected			
											S	O	D	RPN
Coating	Inhomogeneous paste in mixing tank	Deviation of coating quality	5	Level of impeller does not match with level of paste	5	Control by setting the level of paste in mixing tank	4	100	No action	-				
	Inhomogeneous paste in mixing tank	Deviation of coating quality	5	Stirring time is not suitable	4	Specify into the formulation	5	100	Revise work instruction	Production Eng. (8/6/07)				
	Inhomogeneous paste in mixing tank	Deviation of coating quality	5	Stirring speed does not suit with paste volume	5	Indicate in work instruction	4	100	No action	-				
	Inhomogeneous paste in mixing tank	Deviation of coating quality	5	Operators don't follow formulation	6	Instruction in formulation sheet	4	120	Training operators to make them realise the consequence	Production Eng. (8/6/07)				
	Improper brush speed	Off-spec products/ products need quality adjustment	7	Deviation of paste type	6	Indicate in work instruction	5	210	Updating work instruction	Process Eng. (5/6/07)				
	Improper brush speed	Off-spec products/ products need quality adjustment	7	Operators don't follow instruction strictly	5	Indicate in work instruction	5	175	Training operators to make them realise the consequence	Production Eng. (8/6/07)				

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected			
											S	O	D	RPN
Coating	Improper conveyor speed	Off-spec products/ products need quality adjustment	7	Deviation of paste type	7	Indicate in work instruction	5	245	Updating work instruction	Process Eng. (5/6/07)				
	Improper conveyor speed	Off-spec products/ products need quality adjustment	7	Operators don't follow instruction strictly	5	Indicate in work instruction	5	175	Training operators to make them realise the consequence	Production Eng. (8/6/07)				

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected S	Expected O	Expected D	Expected RPN
Drying	Inaccurate temp. in drying rooms	Products have high humidity (off-spec)	5	Poor maintenance, Temp. indicator false	5	Regular check of temp. indicator	3	75	set up work instruction for calibration	Maintenance (15/6/07)				
	Non-suitable temp. in drying rooms	Products have high humidity (off-spec)	5	Low efficiency of blowers	4	No control	7	140	set up work instruction for maintenance	Maintenance (15/6/07)				
	Non-suitable temp. in drying rooms	Products have high humidity (off-spec)	5	Heat loss of hot air during transportation	7	Insulation around hot air tube	5	175	Re-design insulation	Process Eng. (13/6/07)				
	Non-suitable temp. in drying rooms	Products have high humidity (off-spec)	5	Different coated rice feeding	7	Indicate in work instruction	5	175	Updating work instruction to vary drying time according to inlet humidity	Process Eng. (13/6/07)				
	Non-suitable temp. in drying rooms	Products have high humidity (off-spec)	5	Operators don't follow instruction strictly	5	Indicate in work instruction	5	125	Training operators to make them realise the consequence	Production Eng. (8/6/07)				

Process FMEA (Failure Mode and Effect Analysis)

Process name:
Product name:
Team:

Documented by:
Responsible person:

FMEA Date (Org.):
FMEA Date (Rev.):

Process Function & Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	RPN	Recommended Actions(s)	Resonsibility & Target Completion Date	Expected S	Expected O	Expected D	Expected RPN
Drying	Poor distribution of coated rice on belt	Products have high humidity (off-spec)	4	Improper design of hopper	8	No control	6	192	set up PM for hopper	Maintenance (22/6/07)				
	Long drying time	Products are too dry and more energy consumed	4	Ventilation system in drying rooms is not good	8	No inspection and control	8	256	Check flow rate, set PM for ventilation	Maintenance (22/6/07)				
	Inaccurate temp. at gas burner	Products have high humidity (off-spec)	5	Poor maintenance	5	Temp. check every shift	2	50	set up work instruction for calibration	Maintenance (22/6/07)				
	Insufficient heat generation from gas burners	Products have high humidity (off-spec)	5	Fuel feed is not enough or feeding is inconsistent	6	Control value of fuel gas	3	90	set up work instruction for calibration	Maintenance (22/6/07)				
	Deposits on drying belt	Energy loss	4	Cleanness of drying belt	8	Stop drying belt for cleaning sometimes	5	160	set up schedule for cleaning	Production (21/6/07)				

Appendix III

Work Instructions

Work Instruction	
Document No. 1 Removal of contaminates in rice	Rev. : 0 Rev. Date : 11/6/07
Operator: Raw material controller	Page : 1 of 2

1. Purpose

This s the method for removal of contaminates from organic rice

2. Scope

This document is used for controlling the quality of rice by describing methods to remove impurities or contaminates from rice. After sun-drying of rice, the removal of impurities and contaminates is manually performed using operators' hands and then the rice is winnowed and sieved before sending to the production process.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- 60 kg sized plastic bag
- Rice pickup equipment
- Sieve
- Rope (for tightening)
- Stainless tables for separation
- Zipped bag for samples and physical hazard
- Hold form
- Record form

6. Safety caution

Use appropriate safety and health device such as rubber gloves, mask, safety shoes, and goggles

Work Instruction	
Document No. 1 Removal of contaminates in rice	Rev. : 0 Rev. Date : 11/6/07
Operator: Raw material controller	Page : 2 of 2

7. Instruction

- Clean and dry the stainless table used for rice separation
- Pick up rice and pour on the table
- Perform separation by removal contaminates and impurities
- Winnow and sieve rice
- Put rice into plastic bags that are placed in 3 layers
- Place the hold form on the bags
- Tighten the plastic bags 2 times by tightening the two inner plastic bags first and then tightening the outside bag
- Final check the plastic bag and place on the canvas support
- Fill the record form

8. Quality records

-

9. Appendix

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Work Instruction	
Document No. 2 (a)	Rev. : 0
Control the quality of coconut milk and Gum Arabic paste	Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 1 of 3

1. Purpose

This is the method for control the quality of coconut milk and Gum Arabic paste

2. Scope

This document is used for controlling the quality of coconut milk and Gum Arabic paste by choosing the suitable composition of raw materials (coconut milk, Gum Arabic, water) to mix with rice in an appropriate ratio in order to make the coating process more efficient.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Organic rice
- Coconut milk
- Gum Arabic powder 20%
- Plastic cylinders with lids
- Beakers
- Water
- Oven
- Viscosity meter
- Record form

6. Safety caution

Use appropriate safety and health device such as rubber gloves, safety shoes, and goggles

Work Instruction	
Document No. 2 (a)	Rev. : 0
Control the quality of coconut milk and Gum Arabic paste	Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 2 of 3

7. Instruction

- Weigh the organic rice 100 g and place it in the plastic cylinders
- Mix coconut milk and Gum Arabic powder in the beakers with different ratios (at least 5 ratios). If it is too viscous, water needs to be added.
- Measure viscosities of the pastes with viscosity meter
- Pour the prepared pastes into the organic rice containing in the plastic cylinders
- Put the lids on and shake the mixtures for 1 minute
- Put the mixtures in the oven and dry at 55 °C for 25 minutes
- Record the quality (i.e. stickiness, lump, uniformity of coating) and quantity of coated rice (i.e. amount of broken rice)
- Cook the coated rice in the rice cookers with the water and coated rice ratio of 1.5:1
- Record the final quality (i.e. stickiness, lump, uniformity of coating, smell, hardness, taste) and quantity of cooked coated rice (i.e. amount of broken rice)

8. Quality records

Quality control inspector record the quality of coated rice both before and after cooking on the Paste Quality Testing Form.

9. Appendix

Example of coating rice with coconut milk and Gum Arabic paste

Work Instruction	
Document No. 2 (a)	**Rev. : 0**
Control the quality of coconut milk and Gum Arabic paste	**Rev. Date : 11/6/07**
Operator: Paste preparation operators	**Page : 3 of 3**

Formula	Coconut milk (ml)	Gum Arabic (ml)	Rice (g)	Drying Temp. (°C)	Time (min)	Result
1	7.5	1.25	100	55	30	- Coating regularly - After drying, individual grain, not broken
2	7.5	2.5	100	55	30	- Coating regularly - After drying, individual grain, not broken
3	7.5	3.75	100	55	30	- Coating regularly - After drying, individual grain, not broken
4	7.5	5	100	55	30	- Coating is caking more than other test - Not free flowing - After drying, grain broken and caking
5	7.5	7.5	100	55	30	- Coating is caking - Exceeding liquid, lump - After drying, grain is cracking

Work Instruction	
Document No. 2 (b)	Rev. : 0
Control the quality of Beetroot and Gum Arabic paste	Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 1 of 3

1. Purpose

This is the method for control the quality of Beetroot and Gum Arabic paste

2. Scope

This document is used for controlling the quality of Beetroot and Gum Arabic paste by choosing the suitable composition of raw materials (Beetroot, Gum Arabic, water) to mix with rice in an appropriate ratio in order to make the coating process more efficient.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Organic rice
- Beetroot
- Gum Arabic powder 20%
- Plastic cylinders with lids
- Beakers
- Water
- Oven
- Viscosity meter
- Record form

6. Safety caution

Use appropriate safety and health device such as rubber gloves, safety shoes, and goggles

Work Instruction	
Document No. 2 (b) Control the quality of Beetrootk and Gum Arabic paste	Rev. : 0 Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 2 of 3

7. Instruction

- Weigh the organic rice 100 g and place it in the plastic cylinders
- Mix beetroot and Gum Arabic powder in the beakers with different ratios (at least 5 ratios). If it is too viscous, water needs to be added.
- Measure viscosities of the pastes with viscosity meter
- Pour the prepared pastes into the organic rice containing in the plastic cylinders
- Put the lids on and shake the mixtures for 1 minute
- Put the mixtures in the oven and dry at 55 °C for 25 minutes
- Record the quality (i.e. stickiness, lump, uniformity of coating) and quantity of coated rice (i.e. amount of broken rice)
- Cook the coated rice in the rice cookers with the water and coated rice ratio of 1.5:1
- Record the final quality (i.e. stickiness, lump, uniformity of coating, smell, hardness, taste) and quantity of cooked coated rice (i.e. amount of broken rice)

8. Quality records

Quality control inspector record the quality of coated rice both before and after cooking on the Paste Quality Testing Form.

9. Appendix

Example of coating rice with Beetroot and Gum Arabic paste

Work Instruction	
Document No. 2 (b)	**Rev. : 0**
Control the quality of Beetroot and Gum Arabic paste	**Rev. Date : 11/6/07**
Operator: Paste preparation operators	**Page : 3 of 3**

Formula	Beetroot (g)	Gum Arabic (ml)	Rice (g)	Drying Temp. (°C)	Time (min)	Result
1	5	5.5	100	55	30	- Coating regularly - After drying, individual grain, not broken
2	5	7.0	100	55	30	- Coating regularly - After drying, individual grain, not broken
3	5	8.5	100	55	30	- Coating regularly - After drying, individual grain, not broken
4	5	10.0	100	55	30	- Coating is caking more than other test - Not free flowing - After drying, grain broken and caking
5	5	11.5	100	55	30	- Coating is caking - Exceeding liquid, lump - After drying, grain is cracking

Work Instruction	
Document No. 2 (c)	Rev. : 0
Control the quality of Galangal and Gum Arabic paste	Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 1 of 3

1. Purpose

This is the method for control the quality of Galangal paste and Gum Arabic paste

2. Scope

This document is used for controlling the quality of Galangal paste and Gum Arabic paste by choosing the suitable composition of raw materials (Galangal paste, Gum Arabic, water) to mix with rice in an appropriate ratio in order to make the coating process more efficient.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Organic rice
- Galangal paste
- Gum Arabic powder 20%
- Plastic cylinders with lids
- Beakers
- Water
- Oven
- Viscosity meter
- Record form

6. Safety caution

Use appropriate safety and health device such as rubber gloves, safety shoes, and goggles

Work Instruction	
Document No. 2 (c) Control the quality of Galangal and Gum Arabic paste	Rev. : 0 Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 2 of 3

7. Instruction

- Weigh the organic rice 100 g and place it in the plastic cylinders
- Mix Galangal and Gum Arabic powder in the beakers with different ratios (at least 5 ratios). If it is too viscous, water needs to be added.
- Measure viscosities of the pastes with viscosity meter
- Pour the prepared pastes into the organic rice containing in the plastic cylinders
- Put the lids on and shake the mixtures for 1 minute
- Put the mixtures in the oven and dry at 55 °C for 25 minutes
- Record the quality (i.e. stickiness, lump, uniformity of coating) and quantity of coated rice (i.e. amount of broken rice)
- Cook the coated rice in the rice cookers with the water and coated rice ratio of 1.5:1
- Record the final quality (i.e. stickiness, lump, uniformity of coating, smell, hardness, taste) and quantity of cooked coated rice (i.e. amount of broken rice)

8. Quality records

Quality control inspector record the quality of coated rice both before and after cooking on the Paste Quality Testing Form.

9. Appendix

Example of coating rice with Galangal and Gum Arabic paste

Work Instruction	
Document No. 2 (c) **Control the quality of Galangal and Gum Arabic paste**	**Rev. : 0** **Rev. Date : 11/6/07**
Operator: Paste preparation operators	**Page : 3 of 3**

Formula	Galangal (g)	Gum Arabic (ml)	Rice (g)	Drying Temp. (°C)	Time (min)	Result
1	5	4.0	100	55	30	- Coating regularly - After drying, individual grain, not broken
2	5	5.5	100	55	30	- Coating regularly - After drying, individual grain, not broken
3	5	7.0	100	55	30	- Coating regularly - After drying, individual grain, not broken
4	5	8.5	100	55	30	- Coating is caking more than other test - Not free flowing - After drying, grain broken and caking
5	5	10.0	100	55	30	- Coating is caking - Exceeding liquid, lump - After drying, grain is cracking

Work Instruction	
Document No. 2 (d) Control the quality of Galangal, Lemon grass and Gum Arabic paste	Rev. : 0 Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 1 of 3

1. Purpose

This is the method for control the quality of Galangal paste, Lemon grass paste and Gum Arabic paste

2. Scope

This document is used for controlling the quality of Galangal paste, Lemon grass paste and Gum Arabic paste by choosing the suitable composition of raw materials (Galangal paste, Lemon grass paste, Gum Arabic, water) to mix with rice in an appropriate ratio in order to make the coating process more efficient.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Organic rice
- Galangal paste
- Lemon grass paste
- Gum Arabic powder 20%
- Plastic cylinders with lids
- Beakers
- Water
- Oven
- Viscosity meter
- Record form

Work Instruction	
Document No. 2 (d) Control the quality of Galangal, Lemon grass and Gum Arabic paste	Rev. : 0 Rev. Date : 11/6/07
Operator: Paste preparation operators	Page : 2 of 3

6. Safety caution

Use appropriate safety and health device such as rubber gloves, safety shoes, and goggles

7. Instruction

- Weigh the organic rice 100 g and place it in the plastic cylinders
- Mix Galangal, Lemon Grass paste and Gum Arabic solution in the beakers with different ratios (at least 5 ratios). If it is too viscous, water needs to be added.
- Measure viscosities of the pastes with viscosity meter
- Pour the prepared pastes into the organic rice containing in the plastic cylinders
- Put the lids on and shake the mixtures for 1 minute
- Put the mixtures in the oven and dry at 55 °C for 25 minutes
- Record the quality (i.e. stickiness, lump, uniformity of coating) and quantity of coated rice (i.e. amount of broken rice)
- Cook the coated rice in the rice cookers with the water and coated rice ratio of 1.5:1
- Record the final quality (i.e. stickiness, lump, uniformity of coating, smell, hardness, taste) and quantity of cooked coated rice (i.e. amount of broken rice)

8. Quality records

Quality control inspector record the quality of coated rice both before and after cooking on the Paste Quality Testing Form.

9. Appendix

Example of coating rice with Galangal, Lemon grass and Gum Arabic paste

Work Instruction	
Document No. 2 (d) **Control the quality of Galangal, Lemon grass and Gum Arabic paste**	**Rev. : 0** **Rev. Date : 11/6/07**
Operator: Paste preparation operators	**Page : 3 of 3**

Formula	Galangal (g)	Lemon grass (g)	Gum Arabic (ml)	Rice (g)	Drying Temp. (°C)	Time (min)	Result
1	2.5	2.5	4.0	100	55	30	- Coating regularly - After drying, individual grain, not broken
2	2.5	2.5	5.5	100	55	30	- Coating regularly - After drying, individual grain, not broken
3	2.5	2.5	7.0	100	55	30	- Coating regularly - After drying, individual grain, not broken
4	2.5	2.5	8.5	100	55	30	- Coating is caking more than other test - Not free flowing - After drying, grain broken and caking
5	2.5	2.5	10.0	100	55	30	- Coating is caking - Exceeding liquid, lump - After drying, grain is cracking

Work Instruction	
Document No. 2 (e)	**Rev. : 0**
Suitable quality of various paste	**Rev. Date : 11/6/07**
Operator: Paste preparation operators	**Page : 1 of 1**

According to the Document No. 2 (a) – (d), suitable ratio of each type of paste for coating 100 gram of rice is summarized as the following table:

Paste type	Suitable ingredient ratio	Viscosity (cSt)
Coconut milk + Gum Arabic (20%)	7.5 ml + (1.25-3.75) ml	
Beetroot + Gum Arabic (20%)	5 g + (5.5-8.5) ml	
Galangal + Gum Arabic (20%)	5 g + (4.0-7.0) ml	
Galangal + Lemon grass + Gum Arabic (20%)	2.5 g + 2.5 g + (4.0-7.0) ml	

Work Instruction	
Document No. 3	Rev. : 0
Control the quality of rice (moisture) during transportation	Rev. Date : 6/6/07
Operator:	Page : 1 of 3

1. Purpose

This is the method for control the quality of rice in terms of moisture from rice miller to the factory

2. Scope

This document is used for controlling the quality of rice in terms of moisture from miller to the factory. Transportation is carried out with the factory own trucks.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Canvas
- Trucks
- Record form

6. Safety caution

-

7. Instruction

- Clean the floors of the trucks before loading rice from the rice miller
- Make sure that the floors of the trucks are dry
- Put the canvas on the floors and on the sides of the carrier at the back of the trucks
- Load rice into the trucks and cover the rice with canvas
- Fill the record form

Work Instruction	
Document No. 3	Rev. : 0
Control the quality of rice (moisture) during transportation	Rev. Date : 6/6/07
Operator:	Page : 2 of 3

- At the point of uploading rice at the factory, inspection of the rice and truck is required again in the following aspects: the precautional measures that there is no contaminates during transportation, trucks still be clean, the rice is not wet, canvas is perfect, etc.
- Fill the record form

8. Quality records

Quality control inspector record the quality of rice in terms of moisture and other contaminates at uploading point.

9. Appendix

Example of Receiving Organic Raw Material Form which is newly generated. The old form records only the quantity of raw material.

Work Instruction	
Document No. 3	Rev. : 0
Control the quality of rice (moisture) during transportation	Rev. Date : 6/6/07
Operator:	Page : 3 of 3

APZ

Receiving Organic Raw Material

CONTROLLED DOCUMENT

Product name:	Manufacture Date :
Code :	Expire Date :
Lot No. :	Quantity :
Supplier name :	Receiving Date :
Supplier Code :	P/O No. :

1. Indication in invoice		
Date and document No.	⟶	
Organic product ?	Y/N	
Odor that certify the product ?	Y/N	
Lot No ?	No.	
2. Transport		
The precautional measures are applied for the Organic	Y/N	
Cleaning motor - veichle	Y/N	
Washing certification	Y/N	
3. Labelling		
Confirm Label ?	Y/N	
Conform wrapper ?	Y/N	
4. Conformity Certifications		
Product conformity certification ?	Y/N	
Accompaining countersigne ?	Y/N	
5. Sampling		
Taked sample ?	Y/N	
Signed ?	Y/N	
Against-sample ?	Y/N	
6. Analysis	Y/N	
Kind of analysis ?	⟶	
Result of the analysis ?	Conf./ NC	
7. Judgment : Approved	Y/N	
8. Attributed: Lot No.	No.	

☐ Accept no condition

☐ Accept with condition .....

☐ Reject / Reason .....

Receive by : ..... Date ...../...../..... Time .....

(Purchase)

Check by : ..... Date ...../...../..... Time .....

Approve by: ..... Date ...../...../..... Time .....

(Q.A Sup.)

APZ-FM-QA-011/ Rev.01 date: 18.10.04 /Issue.28.04.04

Work Instruction	
Document No. 4 Cleaning of paste mixing tanks	Rev. : 0 Rev. Date : 5/6/07
Operator: paste mixing operators	Page : 1 of 1

1. Purpose

This is the method for proper cleaning of paste mixing tanks

2. Scope

This document is used for assigning schedule and procedure for cleaning paste mixing tanks used in the coating process of the factory.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Brush
- Warm water
- Washing up liquid
- Record form

6. Safety caution

-

7. Instruction

- Clean the walls of the mixing tank by using the brush and warm water first.
- If the strain cannot be removed, used washing up liquid solution but make sure that all washing-up liquid solution is completely drained from the tank
- Wash the tank with clean water for at least 3 times
- Fill the record form
- Washing procedure needs to do in every shift (8 hours) or when type of paste for coating is changed.

Work Instruction	
Document No. 5	Rev. : 0
Checking insulation around paste lines at coating process	Rev. Date : 19/6/07
Operator: coating process operators	Page : 1 of 2

1. Purpose

This is the method to control the quality of insulation around paste line in order to prevent solidification of paste

2. Scope

This document is created in order to describe the procedure of schedule checking the efficiency of insulation, methods to evaluate the efficiency of insulation, and the time period to replace old insulation.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Record form
- Soap water
- Clothes

6. Safety caution

-

7. Instruction

- Daily checking the status of insulation around paste lines at costing process are carried out by coating operators. They need to visually check the surface of insulation whether there is any defect or dirt or strains. In case of dirt and strains, operators have to remove them and clean insulation. For defect, they have to inform production engineer immediately for replacement.

Work Instruction	
Document No. 5	Rev. : 0
Checking insulation around paste lines at coating process	Rev. Date : 19/6/07
Operator: coating process operators	Page : 2 of 2

- For actual checking the efficiency of insulation, the service staff from the company that sold the insulation will be called to visit and check the efficiency in every six months. The time period to replace old insulation depends on the recommendation of the sale services.

Work Instruction	
Document No. 6 Cleaning of coating brushes	Rev. : 0 Rev. Date : 12/6/07
Operator: Coating process operators	Page : 1 of 1

1. Purpose

This is the method for proper cleaning of coating brushes at coating drum

2. Scope

This document is used for assigning schedule and procedure for cleaning coating brushes at coating drum of the factory.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Hot water
- Record form

6. Safety caution

-

7. Instruction

- Clean the coating brush with hot water by selecting "Cleaning" button at the control panel of the coating drum in every shift or when types of coating paste are changed. This will take about 15 minutes.
- Fill the record form

Work Instruction	
Document No. 7 Air humidity control at coating drum	Rev. : 0 Rev. Date : 12/6/07
Operator: Coating process operators	Page : 1 of 3

1. Purpose

This is the method for control air humidity at coating drum.

2. Scope

This document is used for assigning procedure for using air humidity control at coating drum.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- EH3 Electronic Humidistat and Controller as shown in the below picture
- Record form

6. Safety caution

-

7. Instruction

- Make sure that the humidity controller (Model 'EH3 Electronic Humidistat and Controller") is on all the time and set up value at suitable relative humidity between 20-30% as suggested from the experimental results in Table 1.
- Coating drum operators are required to record humidity of the air read from the control in the form in every hour.
- When the read value of air humidity is different from the target value about 2 °C, the dehumidification function at the controller will automatically work and the target value will be achieved within 5 minutes. If not, the operators have to inform the production engineers.

Work Instruction	
Document No. 7	Rev. : 0
Air humidity control at coating drum	Rev. Date : 12/6/07
Operator: Coating process operators	Page : 2 of 3

EH3 - Electronic humidistat and controller

The EH3
can regulate and monitor:

- *Relative humidity % RH*
- *Absolute humidity g/kg*
- *Dew-point °Cdp*
- *Temperature °C / K / °F*

Two closing contacts:

Possible to choose source from one of the four parameters above to each relay. Used for controlling one dehumidifier in two steps or to control two separate dehumidifiers. Can also be used for dehumidifying on one relay and temperature control on the other.

Display and diodes:

2 row display where two parameters can be monitored. Green "Normal" diode and red "Alarm" diode, switches at a set value of any of the four parameters.

Analogue outputs:

2 outputs with Vdc or mA, choose source from the PI-regulator or one of the four parameters above.

PI-regulator:

Controls energy-saving on a three phase dehumidifier or a valve for a cooling coil. Set relative humidity, absolute humidity, dew-point or temperature and EH-3 will keep it constant.

Sensor:

Capacitive type moisture sensor from Honeywell with an accuracy of <±2%RH and <±0,5° C. Each sensor comes with a calibration protocol.

Work Instruction	
Document No. 7 Air humidity control at coating drum	Rev. : 0 Rev. Date : 12/6/07
Operator: Coating process operators	Page : 3 of 3

Table 1; Experimental results of appropriate drying time according to the various air humidity

Relative humidity in air (%)	Suitable drying time (minutes) at 55 °C for products having 5% humidity				
	Run 1	Run 2	Run 3	Run 4	Range
20	123	126	120	125	120-126
25	122	122	127	123	122-127
30	129	120	125	130	120-130
35	125	130	133	145	125-145
40	154	145	140	157	140-157
45	162	166	174	179	162-179
50	188	180	171	192	171-192
55	188	189	199	202	188-202
60	209	200	198	195	195-209
65	214	200	207	210	200-214
70	223	220	216	215	215-223

Work Instruction	
Document No. 8 Suitable stirring time for paste mixing	Rev. : 1 Rev. Date : 8/6/07
Operator: Coating process operators	Page : 1 of 2

1. Purpose

This is the method for determining suitable stirring time for paste mixing in order to ensure that paste is mixed uniformly and homogeneously.

2. Scope

This document is used for assigning procedure for determining suitable stirring time for paste mixing according to different types of paste.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Different types of paste
- Pilot mixing tank
- Record form

6. Safety caution

-

7. Instruction

- Prepare different types of paste according to the ingredient ratio used in the real process.
- For each type of paste, put the paste into the pilot mixing tank.
- Set up the stirring speed as same as that used in the real mixing tanks
- Start stirring and timing
- Collect samples from the mixing tank at every 5 minutes to visual check that the ingredient are uniformly mixed.
- Record the result into the form

Work Instruction	
Document No. 8 **Suitable stirring time for paste mixing**	**Rev. : 1** **Rev. Date : 8/6/07**
Operator: Coating process operators	**Page : 2 of 2**

- Head of QC is responsible for creating suitable stirring time and report this to the production team
- This experiment needs to be carried out in every month since paste properties and types are always not the same

8. Appendix

Example of experimental results for determining suitable stirring time for paste mixing

Paste type	Does the paste is uniformly mixed? (Y/N) at					
	5 min	10 min	15 min	20 min	25 min	30 min
Coconut milk + Gum Arabic (20%)	N	N	Y	Y	Y	Y
Beetroot + Gum Arabic (20%)	N	N	N	Y	Y	Y
Galangal + Gum Arabic (20%)	N	N	N	Y	Y	Y
Galangal + Lemon grass + Gum Arabic (20%)	N	N	N	Y	Y	Y

According to the above table: suitable stirring time for:

- Coconut milk + Gum Arabic (20%) is 15 minutes
- Beetroot + Gum Arabic (20%) is 20 minutes
- Galangal + Gum Arabic (20%) is 20 minutes
- Galangal + Lemon grass + Gum Arabic (20%) is 20 minutes

Work Instruction	
Document No. 9	Rev. : 0
Calibration sheet for temperature indicator at coating drum	Rev. Date : 15/6/07
Operator: Coating drum foreman	Page : 1 of 2

1. Purpose

This document is generated in order to control the accuracy of temperature indicators used at coating drum and the frequency of checking the indicators

2. Scope

This calibration sheet is applicable to the temperature indicators used at the coating drum when rice is coated with prepared pastes.

3. Definition/abbreviation

-

4. References

-

5. Equipment/material

- Calibrated infrared temperature indicator
- Record form

6. Safety caution

-

7. Instruction

- After the rice and prepared paste have been loaded to the coating drum unit, coating drum foreman inspect the accuracy of the temperature indicators at the coating drum unit by using a calibrated infrared temperature indicator for comparison
- Fill the record form and error should not be ±2%
- Inspection has to be carried out in every shift

Work Instruction	
Document No. 9	Rev. : 0
Calibration sheet for temperature indicator at coating drum	Rev. Date : 15/6/07
Operator: Coating drum foreman	Page : 2 of 2

8. Appendix

Calibration sheet for temperature indicator at coating drum

Temp indictor No.	Set point temp (°C)	Test Point (°C)	Actual* (°C)	%Error
1	60	59		
2	60	58		
3	60	61		

* From a calibrated infrared temperature indicator

Tested by: ..... Date : .....

Approved by: ..... Date : .....

Work Instruction	
Document No. 10 Checking insulation at pipes from hot air tank to drying rooms	Rev. : 0 Rev. Date : 13/6/07
Operator: Drying process operators	Page : 1 of 2

1. Purpose

This is the method to control the quality of insulation at pipes from hot air tank to drying rooms in order to prevent heat loss

2. Scope

This document is created in order to describe the procedure of schedule checking the efficiency of insulation, methods to evaluate the efficiency of insulation, and the time period to replace old insulation.

3. Definition/abbreviation

-

4. Equipment/material

- Record form
- Soap water
- Clothes

5. Safety caution

-

6. Instruction

- Daily checking the status of insulation at pipes from hot air tank to drying rooms is carried out by coating operators. They need to visually check the surface of insulation whether there is any defect or dirt or strains. In case of dirt and strains, operators have to remove them and clean insulation by soap water. For defect, they have to inform production engineer immediately for replacement.

Work Instruction	
Document No. 10 Checking insulation at pipes from hot air tank to drying rooms	Rev. : 0 Rev. Date : 13/6/07
Operator: Drying process operators	Page : 2 of 2

- For actual checking the efficiency of insulation, the service staff from the company that sold the insulation will be called to visit and check the efficiency in every six months. The time period to replace old insulation depends on the recommendation of the sale services.

Work Instruction	
Document No. 11 **Control drying temperature and drying time in drying rooms**	**Rev. : 0** **Rev. Date : 13/6/07**
Operator: Drying room operators	**Page : 1 of 4**

1. Purpose

This document is generated to control the drying temperature and drying time in drying rooms according to the inlet humidity of coated rice feed.

2. Scope

This instruction is applicable to drying rooms

3. Equipment/material

- Organic rice
- Galangal paste
- Lemon grass paste
- Beetroot powder
- Coconut milk
- Gum Arabic powder 20%
- Beakers
- Water
- Oven
- Humidity meter
- Record form

4. Instruction

- Prepare various types of paste with suitable ratios determined by Document No. 2 and mixed with organic rice
- For a particular type of paste, measure the humidity of the coated rice
- Divide the coated rice at a particular humidity into several samples and placed in the oven to dry at 45 °C
- Take out each sample at different drying times starting from 60 minutes to 180 minutes with time interval of 20 minutes

Work Instruction	
Document No. 11 Control drying temperature and drying time in drying rooms	Rev. : 0 Rev. Date : 13/6/07
Operator: Drying room operators	Page : 2 of 4

- Record and check the quality of dried coated rice in terms of humidity that pass the specification
- Repeat step 3 – 5 by changing the temperature of drying to 50, 55, 60, 65, and 70 °C
- Change the type pf paste

5. Appendix

Example of drying result and drying chart for coated rice (rice 100 g + Coconut milk 7.5 ml + Gum Arabic (20%) 1.25 ml) with initial humidity of 20%

Table 5.1: Drying temperature and drying time of coated rice (rice 100 g + Coconut milk 7.5 ml + Gum Arabic (20%) 1.25 ml with initial humidity of 20%

Drying temperature (°C)	Drying time (minutes)	Result	
		Humidity (%)	Quality pass*
45	60	14.8	Not pass
	80	13.6	Not pass
	100	13	Not pass
	120	12.5	Not pass
	140	11.4	Not pass
	160	10.6	Not pass
	180	10	Not pass
50	60	12.4	Not pass
	80	11.2	Not pass
	100	10.1	Not pass
	120	9.5	Not pass
	140	8.5	Not pass
	160	7	Not pass
	180	6.8	Not pass
55	60	10.8	Not pass
	80	9.1	Not pass
	100	8	Not pass
	120	7.3	Not pass
	140	6.1	Not pass
	160	4.7	Pass
	180	4	Pass

Work Instruction	
Document No. 11 **Control drying temperature and drying time in drying rooms**	**Rev. : 0** **Rev. Date : 13/6/07**
Operator: Drying room operators	**Page : 3 of 4**

Drying temperature (°C)	Drying time (minutes)	Result Humidity (%)	Quality pass*
60	60	9.6	Not pass
	80	6.5	Not pass
	100	5.4	Not pass
	120	5.2	Not pass
	140	3.9	Pass
	160	2.7	Pass
	180	2.3	Pass
65	60	7.5	Not pass
	80	5	Not pass
	100	4.5	Pass
	120	4	Pass
	140	3.1	Pass
	160	2.3	Pass
	180	1.8	Pass
70	60	6.1	Not pass
	80	3.5	Pass
	100	2.8	Pass
	120	1.5	Pass
	140	1.3	Pass
	160	1.2	Pass
	180	1.1	Pass

* Humidity specification of final coated rice is not more than 5%

Work Instruction	
Document No. 11 Control drying temperature and drying time in drying rooms	Rev. : 0 Rev. Date : 13/6/07
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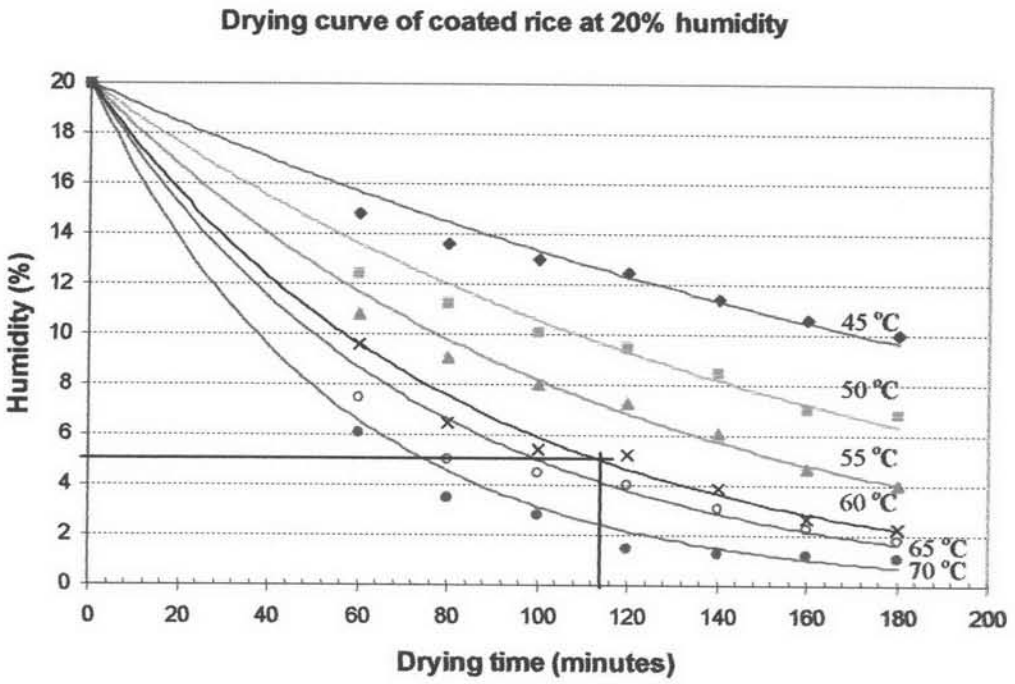

From the graph, it can be used as a guideline for the actual process when coated rice (rice 100 g + Coconut milk 7.5 ml + Gum Arabic (20%) 1.25 ml) is dried at various drying temperature. For example, if the drying temperature in drying room is set up at 60 oC and the humidity specification of the product is 5%, the suitable drying time is about 114 minutes

Work Instruction	
Document No. 12 Cleaning of drying belt	Rev. : 0 Rev. Date : 21/6/07
Operator: Drying process operators	Page : 1 of 1

1. Purpose

This is the method for schedule of cleaning of drying belt at drying rooms

2. Scope

This document is used for assigning schedule and procedure for cleaning drying belt at drying rooms of the factory.

3. References

-

4. Equipment/material

- Hot water
- Record form

5. Safety caution

-

6. Instruction

- Clean the drying belt with hot water manually in every shift (8 hours) as shown in the below Table

Date	Time	Cleaning
	8.00	With hot water
	16.00	With hot water
	24.00	With hot water

- Fill the record form

Appendix IV

Preventive Maintenance Plan

Preventive Maintenance Plan

Machine No.	Machine	Location	Detail	Responsible Person	Due Date
005-07	Ventilation system	Drying rooms	Inspection and cleaning the ventilation system in drying rooms	Maintenance	Daily
004-13	Hopper	Drying rooms	Inspect any obstruct occurring at the hopper	Maintenance	Daily
004-01	Screw conveyor	Drying rooms	Inspect any stick materials and clean the screw conveyor	Maintenance	Daily
004-08	Blowers	Drying rooms	Inspect, clean, and fill the lubricating oil into the blowers	Maintenance	Weekly

BIOGRAPHY

Monnadda Naddapan was born in Bangkok in1980. She graduated in 2004 from Thammasat University and University of Nottingham in Bachelor of Mechanical Engineering. She continues her master's degree at Regional Centre for Manufacturing Systems Engineering in Master of Engineering in Engineering Management which offered by Chulalongkorn University and Master of Science in Engineering Business Management which offered by University of Warwick