NATION'S MANPOWER REVOLUTION

NATIONAL COMMISSION ON AUTOMATION AND TECHNOLOGICAL PROGRESS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON EMPLOYMENT AND MANPOWER

OF THE

COMMITTEE ON LABOR AND PUBLIC WELFARE

UNITED STATES SENATE

EIGHTY-EIGHTH CONGRESS

SECOND SESSION

ON

S.J. Res. 105, S. 2298, S. 2427, and S. 2623

PART 10

JULY 6, 1964

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NATION'S MANPOWER REVOLUTION

National Commission on Automation and Technological Progress

MONDAY, JULY 6, 1964

U.S. SENATE,
SUBCOMMITTEE ON EMPLOYMENT AND MANPOWER
OF THE COMMITTEE ON LABOR AND PUBLIC WELFARE,
Washington, D.C.

The subcommittee met at 10:40 a.m., pursuant to call, in room 4232, New Senate Office Building, Senator Joseph S. Clark, chairman of the subcommittee, presiding.

Present: Senators Clark (presiding) and Randolph.

Committee staff members present: Stewart E. McClure, chief clerk; Edward D. Friedman, counsel; Frazier Kellogg, professional staff member, of the subcommittee; and Michael J. Bernstein, minority counsel.

Senator CLARK. The subcommittee will be in session. We are meeting this morning to take testimony from the Secretary of Commerce and the Secretary of Labor, on S. 2298, Senate Joint Resolution 105, and S. 2427, introduced by Senator Humphrey for himself and several other Senators, including me, on January 15, 1964, and on S. 2623, introduced on March 10 by Senator Hart, of Michigan, for himself and several other Senators, including Senator Randolph and myself.

This is a bill to establish a National Commission on Automation and Technological Progress.

The committee has already heard some 26 witnesses in this same general legislative area, testifying largely on Senate Joint Resolution 105, introduced on July 25, 1963, by Senator Javits for himself and a number of other Senators, including Senator Randolph and me, and S. 2298, introduced on November 8, 1963, by Senator Hart for himself, Senator Humphrey, and me.

What we hope to do is to distill from the wisdom I am sure we will receive this morning from Secretaries Hodges and Wirtz, the proper kind of a bill for the subcommittee to recommend to the full committee dealing with the whole problem of the creation of a commission of some sort to deal with automation, technological progress, the application of technology to community and manpower needs, automation technology and employment, including, I would hope, some consideration of the potential impact of possible disarmament on employment, manpower, and the defense effort.

(The bills primarily referred to and departmental reports follow:)

88TH CONGRESS
1ST SESSION

S. J. RES. 105

IN THE SENATE OF THE UNITED STATES

JULY 25, 1963

Mr. JAVITS (for himself, Mr. CLARK, Mr. COOPER, Mr. DOUGLAS, Mr. FONG, Mr. INOUYE, Mr. LONG of Missouri, Mr. MORSE, and Mr. RANDOLPH) introduced the following joint resolution; which was read twice and referred to the Committee on Labor and Public Welfare

JOINT RESOLUTION

To authorize appointment of a Presidential Commission on Automation.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That Congress hereby finds that technological change and economic adjustment are essential to the advancement of national prosperity and power, but that the associated readjustment of workers displaced by automation, industrial relocation, shifts in market demand, and other factors of economic change, is a major problem facing the Nation, particularly in view of the current level of general unemployment. The Congress declares that a wise and timely solution of these

problems can benefit the entire Nation through increased output and productivity and the avoidance of hardship to individual workers. It can also make a decisive contribution to other major economic problems facing the Nation, including underutilization and obsolescence of production facilities and increased labor management friction. The Congress further declares that a variety of means to insure increased productivity while lessening the impact of job displacement upon the individual worker, including measures designed to raise the general level of employment, as well as retraining, relocation, early retirement, improved rehiring and employment services, and interim compensation during unemployment, must be explored and are a responsibility of industry, and where necessary also of Government, and require recognition of the fact that measures which promote speedier and more equitable worker adjustment to economic change also increase national productivity, income, and wealth.

PRESIDENTIAL COMMISSION ON AUTOMATION AND EMPLOYMENT

SEC. 2. (a) The President of the United States is hereby authorized to appoint a Presidential Commission on Automation and Employment (hereinafter referred to as the "Commission"), which shall be composed of twenty-five members as follows:

(1) Five members who shall be representative of industry and commerce in large and small business and in various industries;

(2) Five members who shall be representative of labor organizations in various occupations and industries;

(3) Two members who are recognized experts in labor-management relations, at least one of whom shall be from the academic field;

(4) Two members who are experts in science and technology and its economic implications, at least one of whom shall be from the academic field;

(5) Six members who shall be representative of the general public, and who shall be selected without regard to any interest or connection they may have with any of the foregoing areas. The President shall appoint a Chairman from among these public members.

(6) As ex officio members, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Labor, and the Secretary of Health, Education, and Welfare, the Director of the Office of Science and Technology, and the Chairman of the Council of Economic Advisers.

(b) Members of the Commission referred to in paragraphs (1) to (5) of subsection (a) shall receive compensation at the rate of $100 per diem while performing services for the Commission, and while away from their homes in

connection with attendance at meetings of the Commission shall be entitled to transportation expenses and per diem in lieu of subsistence at the rate prescribed by, or established pursuant to, section 5 of the Administrative Expenses Act of 1946, as amended (5 U.S.C. 73b–2).

(c) The President is authorized to appoint, by and with the advice and consent of the Senate, an Executive Director of the Commission. The Executive Director shall be the principal executive officer of the Commission and shall be paid compensation at the rate of $20,000 per annum. The Commission is authorized to appoint, in accordance with the civil service laws, rules, and regulations, and fix the compensation in accordance with the Classification Act of 1949, as amended, of such other officers and employees as may be necessary: *Provided,* That not more than ten officers and employees may be appointed without regard to civil service laws, rules, and regulations, and to let contracts to perform such work as is necessary.

(d) With the consent of the heads of other departments and agencies of the Government, the Commission is authorized to utilize the personnel, services, and facilities of such departments and agencies in carrying out its functions under this Act. Such departments and agencies shall cooperate with the Commission to the greatest extent practicable for such purpose; and the Commission shall utilize, to the great-

est extent practicable, data, analyses, and studies furnished by the appropriate Federal agencies and shall give due regard to the findings of major public and private research groups that have studied or concurrently are studying the problem of employment and technological progress.

(e) The Commission shall transmit to the President and to the Congress interim reports of its activities under this Act at such times as the President or the Commission deems desirable and a final report of its activities under this Act by January 1, 1965.

PURPOSE AND FUNCTIONS OF THE COMMISSION

SEC. 3. The Commission shall—

(1) make findings with respect to—

(a) the identification and description of the major types of technological and economic changes which are likely to occur during the next ten years, and their effect upon the nature of employment requirements;

(b) the recent and prospective pace of technological change, its impact on productivity, its incidence upon particular occupations and groups of workers, and its other effects upon the Nation's economy, communities, families, social structure, and human values.

(c) the relationship between the general level

of unemployment and the particular employment consequence of technological progress, and an identification of the major conditions for and existing obstacles to the speedy reemployment, or other equitable adjustment, of workers displaced by automation and other forms of economic change.

(2) describe those actions, properly the responsibility of management, labor, and State and local government which can be undertaken to deal with the social and economic problems of individual workers and management personnel adversely affected by technological and economic change; and

(3) make recommendations to the President and the Congress of the kind of administrative and legislative measures which will fulfill the proper responsibility of the Federal Government to identify in advance the prospective technological and economic changes and to prevent or alleviate the hardships associated with job displacement, and to share the costs of technological and economic change in such a way as to assure the continued advance of the Nation's technology and productivity and the continued well-being of the Nation's people.

APPROPRIATIONS

SEC. 4. There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act.

88TH CONGRESS
1ST SESSION

S. 2298

IN THE SENATE OF THE UNITED STATES

NOVEMBER 8 (legislative day, OCTOBER 22), 1963

Mr. HART (for himself, Mr. HUMPHREY, and Mr. CLARK) introduced the following bill; which was read twice and referred to the Committee on Labor and Public Welfare

A BILL

To establish a Commission on the Application of Technology to Community and Manpower Needs, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is hereby declared to be the policy of Congress to promote the application of recent technological advances to meeting large-scale human, community, industrial, and manpower needs of this Nation. Such an objective can be most effectively achieved by—

(a) determining the impact fuller utilization of new technologies will have on future manpower requirements of the labor force;

(b) defining those areas of unmet community and human needs where application of new technologies might most effectively be directed;

(c) examining technological developments that have occurred in recent years, particularly those resulting from the Federal Government research and development programs, with a view to discovering those areas potentially most promising for civilian and industrial exploitations;

(d) reporting on ways by which civilian research and development, together with uses of existing technology, can more effectively be directed in areas where major social and economic benefits may be achieved;

(e) recommending proper relationship between governmental and private investment in the application of new technologies to large-scale human and community needs;

(f) analyzing the balance and impact among domestic industry to see how the benefits from expenditure of Federal funds may accrue to a wider segment of such industry;

(g) defining proper responsibility and organization of agencies in the executive branch to achieving these objectives; and

(h) recommending ways in which the legislative

branch of the Government can be better staffed to fulfill the objectives of this policy.

ESTABLISHMENT OF THE COMMISSION ON THE APPLICATION OF NEW TECHNOLOGY TO COMMUNITY AND MANPOWER NEEDS

SEC. 2. (a) For the purpose of carrying out the policy set forth in the first section of this Act, there is hereby established a commission to be known as the Commission on the Application of New Technology to Community and Manpower Needs (referred to hereinafter as the "Commission").

(b) The Commission shall be composed of fourteen members as follows:

(1) Eight appointed by the President of the United States, four from the constituent Federal agencies belonging to the Federal Council for Science and Technology, and four from private life who have had distinguished careers in labor, industry, local government, or higher education;

(2) Two appointed by the President of the Senate from Members of the Senate;

(3) Two appointed by the Speaker of the House of Representatives from Members of the House of Representatives; and

(4) Two appointed by the President of the National Academy of Sciences.

(c) Any vacancy in the Commission shall not affect its

powers, but shall be filled in the same manner in which the original appointment was made.

(d) Service of an individual as a member of the Commission or employment of an individual by the Commission as an attorney or expert in any business or professional field, on part-time or full-time basis, with or without compensation, shall not be considered as service or employment bringing such individual within the provisions of sections 203, 204, 205, 207, 208, and 209 of title 18 of the United States Code.

(e) The Commission shall elect a Chairman and a Vice Chairman from among its members.

(f) Eight members of the Commission shall constitute a quorum.

ADVISORY PANEL TO THE COMMISSION ON THE APPLICATION OF NEW TECHNOLOGY TO COMMUNITY AND MANPOWER NEEDS

SEC. 3. The Commission may establish an Advisory Panel which shall consist of persons of exceptional competence and experience in the fields of science and technology, economics, political science, or operations analysis. Such Advisory Panel members shall be drawn equally from the Government, private industry, and nonprofit educational and technological institutions, and shall be persons available to act as consultants for the Commission.

COMPENSATION OF MEMBERS OF THE COMMISSION

SEC. 4. (a) Members of Congress who are members of the Commission shall serve without compensation in addition to that received for their services as Members of Congress; but they shall be reimbursed for travel, subsistence, and other necessary expenses incurred by them in the performance of the duties vested in the Commission.

(b) The members of the Commission who are in the executive branch of the Government shall serve without compensation in addition to that received for their services in the executive branch, but they shall be reimbursed for travel, subsistence, and other necessary expenses incurred by them in the performance of the duties vested in the Commission.

(c) The members of the Commission appointed from private life shall each receive $75 per diem when engaged in the actual performance of duties vested in the Commission, plus reimbursement for travel, subsistence, and other necessary expenses incurred by them in the performance of such duties.

STAFF OF THE COMMISSION

SEC. 5. (a) The Commission may appoint and fix the compensation of such personnel as it deems advisable in

accordance with the provisions of the civil service laws and the Classification Act of 1949.

(b) The Commission may procure, without regard to the civil service laws and the classification laws, temporary and intermittent services (including those of members of the Advisory Panel) to the same extent as authorized for the departments by section 15 of the Act of August 2, 1946 (60 Stat. 810; 5 U.S.C. 55a), but at rates not to exceed $75 per diem for individuals.

DUTIES OF THE COMMISSION

SEC. 6. (a) The Commission shall make a comprehensive and impartial study and investigation of the programs and policies of governmental and private institutions to determine the most effective ways by which such institutions can promote the purposes and objectives set forth in the first section of this Act.

(b) During the course of its study and investigation the Commission may submit to the President and the Congress such reports as the Commission may consider advisable. The Commission shall submit to the President and the Congress a final report with respect to its findings and recommendations not later than January 1, 1965.

POWERS OF THE COMMISSION

SEC. 7. (a) (1) The Commissioner or, on the authorization of the Commission, any subcommittee thereof, may, for the purpose of carrying out its functions and duties, hold such hearings and sit and act at such times and places, administer such oaths, and require, by subpena or otherwise, the attendance and testimony of such witnesses, and the production of such books, records, correspondence, memorandums, papers, and documents as the Commission or such subcommittee may deem advisable. Subpenas may be issued under the signature of the Chairman or Vice Chairman, or any duly designated member, and may be served by any person designated by the Chairman, the Vice Chairman, or such member.

(2) In case of contumacy or refusal to obey a subpena issued under paragraph (1) of this subsection, any district court of the United States or the United States court of any possession, or the District Court of the United States for the District of Columbia, within the jurisdiction of which the inquiry is being carried on or within the jurisdiction of which the person guilty of contumacy or refusal to obey is found or resides or transacts business, upon application by the

Attorney General of the United States shall have jurisdiction to issue to such person an order requiring such person to appear before the Commission or a subcommittee thereof, there to produce evidence if so ordered, or there to give testimony touching the matter under inquiry; and any failure to obey such order of the court may be punished by the court as a contempt thereof.

(b) Each department, agency, and instrumentality of the executive branch of the Government, including independent agencies, is authorized and directed to furnish to the Commission, upon request made by the Chairman or Vice Chairman, such information as the Commission deems necessary to carry out its functions under this Act.

EXPENSES OF THE COMMISSION

SEC. 8. There are hereby authorized to be appropriated to the Commission, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary to carry out the provisions of this Act.

88TH CONGRESS
2D SESSION

S. 2427

IN THE SENATE OF THE UNITED STATES

JANUARY 15, 1964

Mr. HUMPHREY (for himself, Mr. BARTLETT, Mr. BREWSTER, Mr. CLARK, Mr. HART, and Mr. WILLIAMS of New Jersey) introduced the following bill; which was read twice and referred to the Committee on Labor and Public Welfare

A BILL

To establish a Commission on Automation, Technology, and Employment.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Congress hereby recognizes that technological progress is essential to the advancement of national prosperity and power. Congress also recognizes the need of promoting the application of recent technological advances to meeting large-scale human, community, industrial, and manpower needs of this Nation. Automation resulting from technological advances, possible changes or reductions in defense spending, and other factors of economic change all

contribute to major industrial and employment problems facing the Nation. The Congress declares that a wise and timely solution of these problems can benefit the entire Nation through increased output and productivity and the avoidance of hardship to individual workers. Such objectives can be most effectively achieved by—

(a) identifying and describing the major types of prospective technological and economic changes which are likely to occur, and their effect upon the nature of employment requirements;

(b) reporting on appropriate policies and programs for economic conversion capability resulting from possible reductions or changes in defense spending;

(c) reporting the recent and prospective pace of technological change, its impact on productivity, its incidence upon particular occupations and groups of workers, and its other effects upon the Nation's economy, communities, families, social structure, and human values;

(d) determining the relationship between the general level of unemployment and the particular employment consequence of technological progress, and identifying the major conditions for and existing obstacles to the speedy reemployment, or other equitable adjustment,

of workers displaced by automation and other forms of economic change;

(e) defining those areas of unmet community and human needs where application of new technologies might most effectively be directed;

(f) examining technological developments that have occurred in recent years, particularly those resulting from the Federal Government research and development programs, with a view to discovering those areas potentially most promising for civilian and industrial exploitations;

(g) reporting on ways by which civilian research and development, together with uses of existing technology, can more effectively be directed in areas where major social and economic benefits may be achieved;

(h) describing those actions, properly the responsibility of management, labor, and government, which can be undertaken to apply new technologies to large-scale human and community needs;

(i) analyzing the balance and impact among domestic industry to see how the benefits from expenditure of Federal funds may accrue to a wider segment of such industry;

(j) initiating appropriate studies and plans by

principal defense contractors so that procedures for reconversion and diversification will be under active consideration;

(k) defining proper responsibility and organization of agencies in the executive branch to achieving these objectives; and

(l) recommending ways in which the legislative branch of the Government can be better staffed to fulfill these objectives.

ESTABLISHMENT OF THE COMMISSION ON AUTOMATION, TECHNOLOGY, AND EMPLOYMENT

SEC. 2. (a) For the purpose of carrying out the policy set forth in the first section of this Act, there is hereby established a commission to be known as the Commission on Automation, Technology, and Employment (referred to hereinafter as the "Commission".

(b) The Commission shall be composed of thirty-two members as follows:

(1) Ten appointed by the President of the United States from the executive branch of the Government representing the Department of Agriculture; Department of Commerce; Department of Defense; Department of Health, Education, and Welfare; Department of Labor; United States Arms Control and Disarmament Agency, Atomic

Energy Commission; National Aeronautics and Space Administration; Office of Science and Technology, and the Council of Economic Advisers;

(2) Five appointed by the President of the Senate from Members of the Senate;

(3) Five appointed by the Speaker of the House of Representatives from Members of the House of Representatives;

(4) Three appointed by the President of the United States who shall be representative of industry and commerce;

(5) Three appointed by the President of the United States who shall be representative of labor organizations; and

(6) Six appointed by the President of the United States who shall be representative of the general public, and who shall be selected without regard to any interest or connection they may have with any of the foregoing areas.

(c) Any vacancy in the Commission shall not affect its powers, but shall be filled in the same manner in which the original appointment was made.

(d) The Commission shall elect a Chairman and a Vice Chairman from among its members.

(e) Seventeen members of the Commission shall constitute a quorum.

ADVISORY PANELS TO THE COMMISSION ON THE APPLICATION OF NEW TECHNOLOGY TO COMMUNITY AND MANPOWER NEEDS

SEC. 3. The Commission may establish advisory panels which shall consist of persons of exceptional competence and experience in the fields of science and technology, economics, political science, or operations analysis. Such advisory panel members shall be drawn equally from the Government, private industry, and nonprofit educational and technological institutions, and shall be persons available to act as consultants for the Commission.

COMPENSATION OF MEMBERS OF THE COMMISSION

SEC. 4. (a) Members of Congress who are members of the Commission shall serve without compensation in addition to that received for their services as Members of Congress; but they shall be reimbursed for travel, subsistence, and other necessary expenses incurred by them in the performance of the duties vested in the Commission.

(b) The members of the Commission who are in the executive branch of the Government shall serve without compensation in addition to that received for their services in the executive branch, but they shall be reimbursed for travel, subsistence, and other necessary expenses incurred by them in the performance of the duties vested in the Commission.

(c) The members of the Commission appointed from private life shall each receive $75 per diem when engaged in the actual performance of duties vested in the Commission, plus reimbursement for travel, subsistence, and other necessary expenses incurred by them in the performance of such duties.

STAFF OF THE COMMISSION

SEC. 5. (a) The Commission may appoint and fix the compensation of such personnel as it deems advisable in accordance with the provisions of the civil service laws and the Classification Act of 1949.

(b) The Commission may procure, without regard to the civil service laws and the classification laws, temporary and intermittent services (including those of members of the advisory panel) to the same extent as authorized for the departments by section 15 of the Act of August 2, 1946 (60 Stat. 810; 5 U.S.C. 55a), but at rates not to exceed $75 per diem for individuals.

DUTIES OF THE COMMISSION

SEC. 6. (a) The Commission shall make a comprehensive and impartial study and investigation of the programs and policies of governmental and private institutions to determine the most effective ways by which such institutions can promote the purposes and objectives set forth in the first section of this Act.

(b) During the course of its study and investigation the Commission may submit to the President and the Congress such reports as the Commission may consider advisable. The Commission shall submit to the President and the Congress a final report with respect to its findings and recommendations within two years after enactment of this Act.

POWERS OF THE COMMISSION

SEC. 7. (a) (1) The Commissioners or, on the authorization of the Commission, any subcommittee thereof, may, for the purpose of carrying out its functions and duties, hold such hearings and sit and act at such times and places, administer such oaths, and require, by subpena or otherwise, the attendance and testimony of such witnesses, and the production of such books, records, correspondence, memorandums, papers, and documents as the Commission or such subcommittee may deem advisable. Subpenas may be issued under the signature of the Chairman or Vice Chairman, or any duly designated member, and may be served by any person designated by the Chairman, the Vice Chairman, or such member.

(2) In case of contumacy or refusal to obey a subpena issued under paragraph (1) of this subsection, any district court of the United States or the United States court of any possession, or the District Court of the United States for the District of Columbia, within the jurisdiction of which the in-

quiry is being carried on or within the jurisdiction of which the person guilty of contumacy or refusal to obey is found or resides or transacts business, upon application by the Attorney General of the United States shall have jurisdiction to issue to such person an order requiring such person to appear before the Commission or a subcommittee thereof, there to produce evidence if so ordered, or there to give testimony touching the matter under inquiry; and any failure to obey such order of the court may be punished by the court as a contempt thereof.

(b) Each department, agency, and instrumentality of the executive branch of the Government, including independent agencies, is authorized and directed to furnish to the Commission, upon request made by the Chairman or Vice Chairman, such information as the Commission deems necessary to carry out its functions under this Act.

EXPENSES OF THE COMMISSION

SEC. 8. There are hereby authorized to be appropriated to the Commission, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary to carry out the provisions of this Act.

88TH CONGRESS
2D SESSION

S. 2623

IN THE SENATE OF THE UNITED STATES

MARCH 10 (legislative day, MARCH 9), 1964

Mr. HART (for himself, Mr. WILLIAMS of New Jersey, Mr. RANDOLPH, Mr. HUMPHREY, Mr. CLARK, and Mr. MORSE) introduced the following bill; which was read twice and referred to the Committee on Labor and Public Welfare

A BILL

To establish a National Commission on Automation and Technological Progress.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Congress finds it imperative to accelerate the national effort to—

(a) identify and assess the past effects and the current and prospective role and pace of technological change;

(b) identify and describe the impact of technological and economic change on production and employment, including new job requirements and the major types of worker displacement, both technological and economic,

which are likely to occur during the next ten years; the specific industries, occupations and geographic areas which are most likely to be involved; and the social and economic effects of these developments on the Nation's economy, manpower, communities, families, social structure, and human values;

(c) define those areas of unmet community and human needs toward which application of new technologies might most effectively be directed, encompassing an examination of technological developments that have occurred in recent years, including those resulting from the Federal Government research and development programs;

(d) assess the most effective means for channeling new technologies into promising directions, including civilian industries where accelerated technological advancements will yield general benefits, and assess the proper relationship between governmental and private investment in the application of new technologies to large-scale human and community needs;

(e) recommend, in addition to those actions which are the responsibility of management and labor, and of State and local governments, specific administrative and legislative steps to be taken by the Federal Government in meeting its responsibility (1) to support and promote

technological change in the interest of continued economic growth and improved well-being of our people, and (2) to continue and adopt measures which will facilitate occupational adjustment and geographical mobility, and (3) to share the costs and help prevent and alleviate the adverse impact of change on displaced workers.

SEC. 2. In order to carry out the objectives of this Act there is hereby established the National Commission on Automation and Technological Progress, hereinafter referred to as the Commission.

SEC. 3. The Commission shall be composed of fourteen members appointed by the President, by and with the advice and consent of the Senate, from among persons outside the Government with a competency in the areas to be dealt with by the Commission. One of such members shall be designated by the President as Chairman of the Commission. Eight members of the Commission shall constitute a quorum. Any vacancy in the Commission shall not affect its power, but shall be filled in the same manner in which the original appointment was made.

SEC. 4. The Commission shall make a comprehensive and impartial study and make recommendations as needed for constructive action in the areas designated in section 1 of this Act.

SEC. 5. Members of the Commission appointed from outside Government shall each receive $100 per diem when engaged in the actual performance of duties of the Commission.

SEC. 6. There is hereby established a Federal Interagency Committee consisting of the heads of the Department of Agriculture, Labor, Commerce, Defense, Health, Education, and Welfare, and the National Aeronautics and Space Administration, and the Chairman of the Council of Economic Advisers, and the Director of the Office of Science and Technology, or their designees, to advise the Commission and to maintain effective liaison with the resources of such departments and agencies. The Chairman of the Committee shall be the Secretary of Labor.

SEC. 7. (a) The Commission shall have power to appoint and fix the compensation of such personnel as it deems advisable, without regard to the provision of the civil service laws and the Classification Act of 1949, as amended. In addition the Commission may procure temporary and intermittent services to the same extent as is authorized for the departments by section 15 of the Act of August 2, 1946 (60 Stat. 810), but at rates not to exceed $75 per diem for individuals.

(b) The Commission is authorized to appoint an execu-

tive secretary to oversee the work of the staff under the general direction of the Commission.

SEC. 8. All members and other personnel of the Commission shall be reimbursed for travel, subsistence and necessary expenses in accordance with law.

SEC. 9. The Department of Labor shall provide the Commission necessary administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) for which payment shall be made in advance, or by reimbursement, from funds of the Commission in such amounts as may be agreed upon by the Commission and the Secretary of Labor.

SEC. 10. The Commission, on the authorization of the Commission, any subcommittee or panel thereof, may, for the purpose of carrying out its functions and duties, hold such hearings and sit and act at such times and places, administer such oaths, and require the attendance of such witnesses, and the production of such books, records, correspondence, memorandums, papers, and documents, as the Commission or such subcommittee may deem advisable.

SEC. 11. The Commission is authorized to negotiate and enter into contracts with private organizations to carry out such studies and to prepare such reports as the Commission feels necessary in order to carry out its duties.

SEC. 12. The Commission is authorized to secure directly from any executive department, agency, or independent instrumentality of the Government any information it deems necessary to carry out its functions under this Act; and each such department, agency, and instrumentality is authorized and directed to cooperate with the Commission and, to the extent permitted by law, to furnish such information to the Commission, upon request made by the Chairman.

SEC. 13. The Commission shall submit a final report of its findings and recommendations to the President and the Congress by January 1, 1966. The Commission shall cease to exist thirty days after submitting its final report.

SEC. 14. There are hereby authorized to be appropriated to the Commission, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary to carry out the provisions of this Act.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF SCIENCE AND TECHNOLOGY,
Washington, August 12, 1963.

Hon. LISTER HILL,
U.S. Senate, Washington, D.C.

DEAR SENATOR: Thank you for the opportunity to comment on Senate Joint Resolution 105, to authorize the appointment of a Presidential Commission on Automation, a measure whose objectives and overall approach I thoroughly endorse. If such a Commission is authorized by the Congress I would be pleased to serve in an ex officio capacity, and would be willing to cooperate in the work of the group in every useful way.

I believe that the intended purpose of the Commission, to assess the nature and effects on productivity and employment of future technological change, is an essential task for the Nation, and that the Federal Government should appropriately take the lead along with representatives of the public to develop a basis for future national policy on this important issue. A Presidential Commission on Automation offers an effective way to bring the perspectives and ongoing work of Government agencies together with the interests and responsibilities of industry, labor, and scholars familiar with the problems of economic adjustment associated with technological change.

I am particularly gratified that both the mandate and composition of the Commission as proposed in Senate Joint Resolution 105 will enable an informed and balanced exploration of the scientific and technical factors that affect the processes of technological change and economic adjustment. It will be important for the Commission to recognize the contributions that technological progress makes to national well-being and prosperity. It will also be important to identify ways in which our constantly increasing store of scientific knowledge can contribute to maintaining maximum levels of productive employment.

Just as the development in the 19th century of textile production in the mill towns of Massachusetts and the rapid spread of railroads to the West created new jobs and opportunities, technology in the age of space and atomic energy has the capability, through the development of new products and processes, to further advance economic growth and the wider diffusion of prosperity to all our people.

Consequently, the proposed Commission could perform a valuable service in assessing the national role that our scientific and technological resources can and should play in future years.

Sincerely,

JEROME B. WIESNER.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., June 12, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: We have been asked for views on four related bills that would establish commissions to study the effects of technological change, including automation, on the economy and to recommend measures for assuring the full benefits of technology while minimizing any adverse effects. These bills are Senate Joint Resolution 105, "To authorize appointment of a Presidential Commission on Automation"; S. 2298, "To establish a Commission on the Application of Technology to Community and Manpower Needs, and for other purposes"; S. 2427, "To establish a Commission on Automation, Technology, and Employment"; and S. 2623, "To establish a National Commission on Automation and Technological Progress." The establishment of the Commission provided for in the last bill was recently recommended by the President, who submitted draft legislation introduced as S. 2623.

The Bureau of the Budget supports the general objectives of all four bills, as it is amply clear that inadequate knowledge of the relationship of technological change to the economy has hampered the development of sound public policy. Recognizing this shortcoming the administration has recently taken certain administrative actions to improve our state of knowledge. For example, the President on December 21, 1963, established a Committee on the Economic Impact of Defense and Disarmament to assess, coordinate, and stimulate studies in this area. The Department of Commerce has been increasing its activities

directed toward determining how best to channel technological information to potential users. The Department of Labor has been giving increasing attention to the current and projected impact of automation on the economy and on the labor force, including studies for the President's Advisory Committee on Labor-Management Policy.

These executive branch actions do not lessen the desirability of a study by an outside group that can provide new perspectives in assessing the relationship of technology to the economy. In our view it is necessary that any such group be so organized as to assure an independent evaluation by individuals who are not constrained by their official positions. Conversely, we believe that the legislative and the executive branches can better maintain their traditional independence to assess recommendations resulting from a study, if their members are not assigned responsibility for preparation of the study.

The legislation recommended by the President, therefore, provides that the Commission be composed of members drawn from outside Government, to be appointed by the President with the advice and consent of the Senate. A Commission so constituted would solicit information and views from members of the legislative and executive branches in the conduct of its work. It would make a comprehensive study of the current and probable future impact of technological change as contrasted with the more specialized studies now underway within Government, which, however, are expected to be of material assistance to the Commission's work.

In focusing on the relationship of technological change to the economy, the scope of the Commission's study should be sufficiently broad to encompass all significant aspects of this complex area. To this end, in preparing draft legislation the administration referred to the various study objectives cited in the other three bills. We believe S. 2623 has benefited greatly from incorporating the best features of the preceding bills.

The Bureau of the Budget urges favorable consideration by your committee of S. 2623, the enactment of which would be in accord with the program of the President.

Sincerely yours,

PHILLIP S. HUGHES,
Assistant Director for Legislative Reference.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF SCIENCE AND TECHNOLOGY,
Washington, June 15, 1964.

Hon. LISTER HILL,
U.S. Senate,
Washington, D.C.

DEAR SENATOR HILL: I am writing in response to your recent requests for comments on S. 2427 (introduced by Senator Humphrey and others to establish a Commission on Automation, Technology, and Employment) and on S. 2623 (introduced by Senator Hart and others to establish a National Commission on Automation and Technological Progress, as recently recommended by the President). Both bills—along with Senate Joint Resolution 105 and S. 2298 on which my predecessor has previously commented—call for a timely and orderly beginning on the development of policies for meeting related national problems of the utmost urgency. Because these matters are so important, I strongly recommend that action be taken in this area during this session of the Congress.

I wish to endorse both the objectives and mechanisms of S. 2623, which I believe would effectively serve the purposes of the other three proposals. In the President's words, that measure would authorize a balanced and objective study of current and future technological trends to seek out recommendations for action "to secure maximum benefits with the least possible harmful effects upon the Nation." I consider it absolutely essential to the future economic and social health of the country that such a standard be applied to the development of national policies to reconcile the Nation's need for continuing technological innovation with those problems of worker displacement that are associated with automation. In addition, S. 2623 would bring able, independent judgment to bear on the vital task of identifying national needs and opportunities for further technological progress, especially in civilian industries, during and after the next decade.

The bill would authorize the undertaking of such a study by a commission of non-Government experts appointed by the President and confirmed by the Senate. In this way, S. 2623 would foster the development of an objective and professionally well qualified perspective on problems that face both the executive and legislative branches, and States and localities as well, now and for the foreseeable future. Furthermore, I believe the provision of a Federal interagency committee to provide advice and liaison would help to make the extensive resources of the executive branch available to the Commission, and, if the measure is enacted, I would be pleased to participate in every useful way.

Sincerely,

DONALD F. HORNIG.

THE CHAIRMAN OF THE COUNCIL OF ECONOMIC ADVISERS,
Washington, June 16, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR SENATOR HILL: You have requested our views on S. 2427 and S. 2623, bills to establish a Commission on Automation and Technological Progress. We share with the sponsors of these bills, and with many other Members of the Congress, concern over the problems with which the proposed Commission would be asked to deal.

Advancing technology is the basic source of our rising standard of living; it reduces the economic burdens of providing for our national security; and it strengthens our ability to assist the economic development of the free world. We recognize, however, that if we are to enjoy fully the benefits of advancing technology, our economic system must be enabled to adapt flexibly and effectively to the changes which such advances produce. As a nation we must put to work the increased productive potential made possible by technological change, in a way which will satisfy more fully the needs of our people. The Federal Government not only has an appropriate role to play in encouraging advancesi n technology but also in facilitating the process of adjustment to such advances. Indeed, these were major themes of chapter 3 of the Council's January 1964 Annual Report.

Furthermore, we agree with one of the underlying premises of the proposed bills that the Federal Government has a special responsibility for facilitating adjustments to significant economic changes, including shifts in the pattern of private and Government demand. We particularly endorse the view that the Federal Government has a responsibility to share the costs and help prevent and alleviate the adverse impact of change on displaced workers.

We agree that these are complex problems that require further study, which may in turn lead to revisions in current Federal policies and programs. And as we have stated before, we feel that a presidentially appointed commission can undoubtedly contribute to our improved understanding of the many difficult problems reflected in the terms of reference of the proposed bills. We, therefore, endorse the general purposes of this legislation.

As you are aware, there are before the Congress at this time a number of proposals along the same general line as S. 2427 and S. 2623. There appears to be a wide consensus on the basic purposes; but we believe that an organizational structure along the general lines provided for in S. 2623 would be most effective. It is our view that a commission appointed by the President made up of private citizens would best accomplish the desired goals.

The Interagency Committee that would be established by S. 2623 would of course work closely with such a commission, providing many of the staff services and such other assistance as the Commission might require. A commission so constituted would be in the best position to undertake an impartial and effective evaluation of the various problems involved, and could develop recommendations most useful to the executive branch and to the Congress.

A mixed commission containing members from the executive and legislative branches as well as private citizens seems to us better adapted to a situation in which the need if primarily to develop solutions to problems whose nature is well understood. In the present case it seems to us that what is needed is an expert commission of private citizens to explore and define the nature of the problem and the possible approaches to solutions.

The Council of Economic Advisers therefore recommends enactment of S. 2623.

The Bureau of the Budget advises that it has no objection to the submission of

this report and that enactment of S. 2623 would be in accord with the program of the President.

Sincerely,

GARDNER ACKLEY, *Acting Chairman.*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
Washington, D.C., June 23, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This replies further to your request for a report by the National Aeronautics and Space Administration on S. 2623, the bill to establish a National Commission on Automation and Technological Progress.

S. 2623 would establish a National Commission on Automation and Technological Progress to be composed of 14 members from outside the Government, appointed by the President with the advice and consent of the Senate. The Chairman would be designated by the President.

The National Commission would study the past, present, and future role of technological change and its impact on production and employment, including worker displacement and new job requirements expected during the next 10 years. The study would include the industries, occupations, and geographic areas likely to be involved, and the social and economic effects of technological change on the Nation. Community and human needs would be defined toward which application of new technologies (including those resulting from Federal research and development programs) might best be directed. Assessment of the most effective means for channeling technological advances into promising directions would be made, including an assessment of the proper relationship between governmental and private investment in such application to community needs. Specific administrative and legislative actions would be recommended for the Federal Government to support and promote technological progress, facilitate occupational adjustment and geographical mobility, and share the costs and help prevent and alleviate the adverse impact of change on displaced workers.

The Commission would be directed to make a comprehensive and impartial study and make a final report of its findings and recommendations to the President and the Congress by January 1, 1966, following which it would be disbanded.

To perform its functions, the Commission would be authorized to appoint an executive secretary and staff without regard to the civil service laws and the Classification Act of 1949, procure temporary and intermittent services, pay travel and other expenses, hold heairngs, administer oaths and subpena witnesses and documents, enter into contracts with private organizations, and secure information from any Government agency. The Department of Labor would provide necessary administrative services, and other agencies would be authorized and directed to cooperate with the Commission, and, to the extent permitted by law, to furnish it with information.

The legislation would also create a Federal interagency committee to advise the Commission and to maintain liaison between the Commission and various agencies. The Committee would be under the chairmanship of the Secretary of Labor and would include the Administrator of the National Aeronautics and Space Administration, or his designee.

The National Aeronautics and Space Administration favors the enactment of S. 2623. The need for such a commission or group to effect such a study exists. There is a deficiency of information with respect to the interrelationships of manpower resources and national objectives, such as defense, space exploration, health, and the application of technology to civilian industries. Such information is vital to effective policy formulation by the executive branch and the Congress.

The Bureau of the Budget has advised that enactment of S. 2623 would be in accord with the program of the President.

Sincerely yours,

RICHARD L. CALLAGHAN,
Assistant Administrator for Legislative Affairs.

GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE,
Washington, D.C., June 26, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Reference is made to your requests for the views of the Department of Defense with respect to S. 2298 to establish a Commission on the Application of Technology to Community and Manpower Needs, and for other purposes, and on S. 2623 to establish a National Commission on Automation and Technological Progress.

Both bills would establish commissions to determine the impact of technological and economic advances on production and employment and to make recommendations on how to apply such advances in the best interests of the Nation while minimizing any adverse effects.

S. 2298 would include on its Commission representatives from the executive and legislative branches as well as from private life while the Commission recommended by S. 2623 would be comprised entirely of non-Government members. Both bills would require the full cooperation of executive departments and agencies.

The Department of Defense is in agreement with the objectives of the bills. Defense supported research and development have contributed to substantial technological advances, many of which have potential application in meeting community and national needs. The Department will cooperate fully with any commission or agency which is established or designated by the Congress to study means of exploiting, for nondefense uses, those skills and technologies which have been created to meet defense needs.

On December 21, 1963, President Johnson established a Committee on the Economic Impact of Defense and Disarmament to assess, coordinate, and stimulate studies in this area. The Departments of Commerce and Labor are actively engaged in their respective roles of determining the best way to channel technological information to potential users and the impact of automation on the economy and the labor force, including studies for the President's Advisory Committee on Labor-Management Policy. It is believed that the Commission, proposed under S. 2623 comprised of persons outside the Government, with competency in the areas to be dealt with, would most effectively complement the above groups in providing solutions to the problems addressed by the two bills.

Under S. 2623, the Commission would recommend, in addition to those actions which are the responsibility of management and labor, and of State and local governments, specific administrative and legislative steps to be taken by the Federal Government in meeting its responsibility.

Accordingly, the Department of Defense recommends enactment of S. 2623 in lieu of S. 2298 as best designed to accomplish the intended purposes.

We have been advsied by the Bureau of the Budget that there is no objection to the submission of this report and that the enactment of S. 2623 would be in accord with the program of the President.

Sincerely,

JACK L. STEMPLER,
(For John T. McNaughton).

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
June 26, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This letter is in response to your request of March 11, 1964, for a report on S. 2623, a bill to establish a National Commission on Automation and Technological Progress.

The bill provides for study and review of the possibilities and problems of automation and technological change by a National Commission to be appointed by the President. The Commission would be responsible for identifying the impact of technological and economic change on American life, including the Nation's economy, manpower, communities, families, social structure, and human values; defining areas of unmet needs where new technology may be required; and recommending programs that will bring about effective adaptation to technological change.

This Department heartily endorses S. 2623. The many promises and problems of automation and technological change are of concern to this Department.

Federal programs in health, education, and welfare will all be affected by and should assist in achieving the promises and alleviating the problems of the technological revolution of the second half of this century.

There is no domestic study role more important or more challenging than the one which would be assigned to the National Commission on Automation and Technological Progress. The potential of technology to fulfill basic economic and health needs of all citizens is immense. The potential of technology to produce severe adverse side effects upon large segments of society, particularly if automation leads to large-scale unemployment, is likewise immense. For these reasons, the Government has both an opportunity and a duty to exercise initiative and leadership in the study of automation and technological change. Appointment of a commission of private citizens to conduct a study with assistance from Federal departments and agencies will provide part of the initiative which is required.

We recommend, therefore, that S. 2623 be passed.

We are advised by the Bureau of the Budget that there is no objection to the presentation of this report from the standpoint of the administration's program and that enactment of S. 2623 would be in accord with that program.

Sincerely,

WILBUR J. COHEN,
Assistant Secretary.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., June 30, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in reply to your request for a report on S. 2623, a bill to establish a National Commission on Automation and Technological Progress, and S. 2427, a bill to establish a Commission on Automation, Technology, and Employment.

The Department favors S. 2623 and recommends that it be passed in preference to S. 2427.

S. 2623 authorizes the establishment of a Commission on Automation and Technological Progress composed of 14 members from among persons outside the Government with a competency in the areas to be dealt with by the Commission. It also provides for the establishment of a Federal Interagency Committee consisting of the Secretaries of the Departments of Agriculture, Labor (Chairman of the Committee), Commerce, Defense, and Health, Education, and Welfare; the heads of the National Aeronautics and Space Administration, the Chairman of the Council of Economic Advisers, and the Director of the Office of Science and Technology, or their designees, to advise the Commission and to maintain effective liaison with their departments or agencies. The bill sets forth the powers and duties of the Commission and provides for its expenses, compensation, and staffing.

The Commission is to make a comprehensive and impartial study of the current and probable future impact of technological change and make recommendations as needed for constructive action to gain the maximum benefit from automation and technological advances and for the prevention and alleviation of adverse impact on displaced workers. The Commission is authorized to negotiate and enter into contracts with private organizations to carry out studies and to prepare such reports as it feels necessary to carry out its duties. It is further authorized to secure directly from any executive department, agency, or instrumentality of the Government any information it deems necessary to carry out its functions. The Commission shall submit a final report of its findings and recommendations to the President and the Congress by January 1, 1966, and it shall cease to exist 30 days after submitting its final report.

The rapid mechanization and other technological changes in agriculture have had, and will continue to have, important effects on increasing production and reducing employment in agriculture. Technological changes in other industries also affect the employment prospects of rural people in nonfarm jobs. We believe, therefore, that the contributions of the proposed Commission will be of benefit in anticipating and alleviating some of the problems associated with technological developments in agriculture.

S. 2623 appears to be an improvement over S. 2427 in several respects. Among other things, it provides for 14 members as compared with the much larger

number in the second bill. The Commission would be composed of people with competency in the area to be studied. The Government stands in particular need of the advise of people who have given special attention to the problems of automation and technology, and it would appear that this could be most quickly provided by the smaller committee of objective experts. S. 2623 provides for participation of the Federal agencies through the proposed Interagency Committee, while the executive Branch, the Congress, the economic interests concerned, and the general public will have full benefit of this urgently needed investigation through the final report and recommendations which will be submitted both to the President and to the Congress.

The Bureau of the Budget advises that there is no objection to the presentation of this report and that enactment of S. 2623 would be in accord with the program of the President.

Sincerely yours,

ORVILLE L. FREEMAN, *Secretary.*

U.S. ATOMIC ENERGY COMMISSION,
Washington, June 30, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate.

Dear Senator HILL: This responds to your letter of November 21, 1963, requesting our comments on S. 2298, a bill to establish a Commission on the Application of Technology to Community and Manpower Needs, and for other purposes.

The primary objective of the proposed Commission study would be to examine thoroughly technological development, particularly that resulting from the Federal Government's research and development effort, with a view to pointing out those areas: (1) potentially most promising for civilian and industrial exploitation; and (2) whose exploitation would create new industries requiring substantial segments of the available manpower and labor force. An additional benefit of the Commission study would be a greater understanding of the feasibility of a transfer of industrial skills and technology from defense-oriented programs to work on civilian programs.

The AEC is very much interested in the areas covered by S. 2298 and is sympathetic to the major objectives of the bill. As we have previously pointed out, the conversion of defense-oriented programs to civilian programs would be one of the problems with which the proposed Commission would be concerned. The problems of economic impact in the event of future defense cutbacks are areas of considerable concern to AEC, and we would particularly like to see them included in any study of manpower, automation and application of technology to human needs. In this connection the President, on December 21, 1963, established a high-level Government committee to coordinate the work of Federal agencies in appraising the economic impacts of disarmament and changes in defense spending.

We believe that the most desirable way to seek answers to these complex problems is through a National Commission on Automation and Technological Progress, proposed by S. 2623, introduced on March 10, 1964. The AEC strongly supports the objectives of S. 2623.

The Bureau of the Budget has advised that there is no objection to the presentation of this report and that enactment of S. 2623 would be in accordance with the program of the President.

Sincerely yours,

A. R. LUEDECKE,
General Manager.

DEPARTMENT OF LABOR,
OFFICE OF THE SECRETARY,
Washington, July 2, 1964.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in further response to your request for our views on S. 2623, a bill to establish a National Commission on Automation and Technological Progress.

We ask that you also consider this report as an expression of our views on the following bills relating to studies of technological change: S. 185, Senate Resolution 50, Senate Joint Resolution 105, S. 2298, and S. 2427. We endorse the objectives of these measures. However, in many respects they overlap and duplicate S. 2623 which we believe proposes the most desirable means of studying this important subject and of developing recommendations for constructive action. We strongly urge the earliest possible enactment of this bill.

It is vitally necessary that we support and promote technological progress which will strengthen our economy. If we properly meet our responsibilities, the new technologies thus developed can yield great benefits to industry generally and satisfy unmet human needs.

We must simultaneously act to safeguard against the sacrifice of human values by helping to prevent and alleviate the adverse effects of such developments on displaced workers and disrupted communities and businesses.

The creation of a National Commission on Automation and Technological Progress as proposed in S. 2623 is a significant step in our efforts to direct and control both the beneficial and potentially harmful effects of technological change.

The activities of the Commission are not a substitute for efforts now being carried on by existing Federal agencies. A high-level national commission will command national attention, respect, and acceptance, and thereby provide effective aid in the development of a common purpose. The proposed Commission's inquiry will be of a scope well beyond that of existing specified study efforts to provide a perspective not feasible from diverse separate examinations. It will also go further than the current studies of the President's Advisory Committee on Labor-Management Policy. As the committee has noted, we need a combination of private and governmental action, consistent with the principle of a free society, in this area. At the request of the President, the committee's studies are emphasing what is being done and can be done to meet adjustment problems through private action.

The proposed Commission will undertake what the President described in his recent Manpower Report as "a broader evaluation of our technological course and the means of channeling (technological) progress toward meeting our society's unfilled needs." It will provide informed guidance on such fundamental subjects as the rapidity with which technological advances are likely to proceed, where they probably will have their greatest impact, what forms such impact will take, and where and how we must specifically prepare to avert undue burdens on individual workers and communities. It can help close the gap between achievement in reserach and the laboratory and its application to the solution of unmet social and economic needs.

This bill provides for a Federal Interagency Committee to assist the Commission in drawing on the knowledge, advice, and resources available from these agencies. In this connection, it is noted that the bill provides for the Secretary of Labor to serve as Chairman of the Interagency Committee. We believe that it should be revised to designate the Secretary of Commerce as Cochariman as reflected in the bill reported by the House Committee on Education and Labor H.R. 11611. The Secretaries of Labor and Commerce now serve as Cochairmen of the President's Committee on Labor-Management Policy. Their working relationship on this Committee, and in fact, throughout this administration has been productive and harmonious. This relationship has been particularly close in dealing with matters in the area of automation and technological change.

We also note that H.R. 11611 makes certain other amendments in the bill to which we have no objection.

The time has come to survey our technological future comprehensively and to project our technological progress to meet national needs, confident that we will minimize and alleviate any adverse effects.

The Bureau of the Budget advises that there is no objection to the submission of this report and that enactment of S. 2623 would be in accord with the program of the President.

Yours sincerely,

W. WILLARD WIRTZ,
Secretary of Labor.

GENERAL COUNSEL OF THE DEPARTMENT OF COMMERCE,
Washington, D.C.

Hon. LISTER HILL,
Chairman, Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This letter is in further response to your requests for views of this Department concerning four bills to establish commissions to study problems relating to automation, and this letter supplements the statement of testimony given by Secretary Hodges before the Subcommittee on Employment and Manpower.

The bills are Senate Joint Resolution 105, to authorize appointment of a Presidential Commission on Automation; Senate 2298, to establish a Commission on the Application of Technology to Community and Manpower Needs, and for other purposes; Senate 2427, to establish a Commission on Automation, Technology, and Employment; and Senate 2623, to establish a National Commission on Automation and Technological Progress. As Secretary Hodges has testified, this Department believes that S. 2623, which was submitted to the Congress by the President, is the most suitable to achieve the objectives included in all of these bills.

As indicated in Secretary Hodges' statement supporting S. 2623, this Department recommends an amendment to provide that the Secretaries of Labor and Commerce shall serve as Cochairmen of the Federal Interagency Committee. Such an amendment was supported by the Secretary of Labor in testimony on H.R. 10310, a companion bill, before the House Select Committee on Labor. For this purpose, we suggest that the last sentence of section 6 of S. 2623 be deleted and the following sentence inserted in lieu thereof:

"The Secretary of Commerce and the Secretary of Labor shall serve as Cochairmen of the Committee."

Also, Secretary Hodges recommended in his statement that section 9 be amended to provide that the Departments of Commerce and Labor shall be jointly responsible for furnishing administrative services for the Commission. For this purpose, we suggest that section 9 be amended to read as follows:

"SEC. 9. The Department of Commerce and the Department of Labor shall provide the Commission necessary administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) for which payment shall be made in advance, or by reimbursement, from funds of the Commission in such amounts as may be agreed upon by the Commission and the Secretaries of Commerce and Labor."

We have been advised by the Bureau of the Budget that there would be no objection to submission of our report from the standpoint of the administration's program and further that enactment of S. 2623 would be in accord with the program of the President.

Sincerely,

ROBERT E. GILES, *General Counsel.*

Senator CLARK. Secretary Hodges, we are very happy to have you with us this morning. I see you have a relatively short, prepared statement. Would you prefer to read it, or would you like to put it in the record?

STATEMENT OF LUTHER H. HODGES, SECRETARY OF COMMERCE, ACCOMPANIED BY ROBERT E. GILES, GENERAL COUNSEL, AND RICHARD H. HOLTON, ASSISTANT SECRETARY FOR ECONOMIC AFFAIRS

Secretary HODGES. I would like to put it in the record Mr. Chairman, and then sort of talk from it.

Senator CLARK. That will be done. The statement of Secretary Hodges will be printed in full in the record at this point.

(The prepared statement of Secretary Hodges follows:)

PREPARED STATEMENT OF LUTHER H. HODGES, SECRETARY OF COMMERCE

Mr. Chairman and members of the subcommittee, I appreciate this opportunity to testify in support of the President's proposal to establish a National Commission on Automation and Technological Progress.

This Nation is facing a challenging dilemma. On the one hand, we must achieve continuous technological change if we are to have rising productivity and hence rising incomes in this country. On the other hand, we must ease the problems which both labor and management face in their attempts to adjust to such change.

This is not a new dilemma—we have faced it in greater or lesser degree almost since our Republic was born. Now, however, the question may be taking on a new urgency. While our competitive position in international markets and our great need for a continually expanding economy call for further technological progress, adjustment to technological change may be increasingly difficult for the affected firms and workers. This bill will provide a charter for our Government and for members of the Commission to review in calm deliberation the problems of technological change.

Under this proposed legislation the President would seek to draw together 14 eminent citizens, with the advice and consent of the Senate, to assist the Nation to promote, understand, and deal more effectively with technological change. More specifically, this Commission is called upon to make some judgment about the current rate and range of technological change compared with that which we have experienced in the past. It would try to foresee the impact of anticipated technical change in terms of the specific industries, occupations, and geographical areas most likely to be involved and to form a judgment about how these developments will affect us as a nation. We seek from this Commission recommendations for policy that will enable us to use our technology to fill some of our unmet needs and to meet our responsibilities as a growing nation.

S. 2623 also provides for a Federal Interagency Committee which would assist the Commission of informed private citizens by making available to them the resources of the various governmental agencies whose work and responsibilities are consistent with the Commission's interest. I wish to note at this point that as section 6 of the bill currently reads, this Federal Interagency Committee would be chaired by the Secretary of Labor. I would like to draw your attention to a change that has been made in the clean House bill, H.R. 11611, which, upon the recommendation of the Secretary of Labor, was amended to read that both the Secretaries of Labor and Commerce would serve as cochairmen of the Interagency Committee. In my view this change was important in that it recognized not only the close relationship that has grown between these two agencies of Government in facing the problems germane to this bill, but also because it reflects the concern of the Commerce Department, whose mandate is to promote and foster the domestic and foreign commerce of the Nation. Such a mandate cannot be fulfilled if the economy does not surge forward by utilizing all its technical knowledge.

In connection with cochairmanship of the Federal Interagency Committee, I should like to suggest an amendment to section 9 which now provides that the Secretary of Labor shall furnish administrative services (including personnel) to the Commission. I think it would be desirable to have both the Secretaries of Labor and Commerce furnish administrative services. Of course, the two Departments would jointly work out arrangements for furnishing such service.

Two other changes have been made in the clean House bill which I am pleased to endorse. First, the name of the Commission has been changed from "National Commission on Automation and Technological Progress" to "National Commission on Technology, Automation, and Economic Progress." This larger scope appears desirable, for the problems of change are, in many cases, the same whether they arise from automation as usually defined or from broader forms of progress.

Second, the original bill provides for recommendations by the Commission as to administrative and legislative steps to be taken by the Federal Government. The clean bill provides that the Commission shall also recommend administrative and legislative steps to be taken by State and local governments. I would endorse this approach, having long felt that the local environment must be receptive to economic adjustment if Federal programs are to be successful.

It is gratifying to note that S. 2623 reflects the three basic points made by the President's Advisory Committee on Labor-Management Policy which the Secretary of Labor and I cochair. This Committee, made up of prominent business and labor leaders, stated that as a nation we must actively promote and encourage the most efficient utilization of all our resources, but we must see to it that the effects of such change are not inequitably shared by our citizens. It was recog-

nized by all that in striking this balance the Government has a role to play. We recently had an opportunity to test the views of this Committee by convening conferences across the country on the subject of adjustments to technological change or automation. At each conference we could sense the total agreement between labor and management that indeed this way of looking at economic change was acceptable to all.

Productivity growth in the economy as a whole is the source of most of our wealth and the principal source of our strength as a nation. We must press for further advances in productivity. Businessmen will look to this Commission to advise us on means of promoting technological advance, in order to increase the Nation's output of goods and services more and more efficiently to the benefit of our overall standard of living.

I am confident that this Nation, with the help of this Commission, will make a major breakthrough in meeting the human adjustment problem associated with progress. But at the same time this Commission can perform a signal service by directing a great portion of its energies to the identification of barriers to the introduction of those technical changes that hold such promise for the future.

We know that the technology of the United States is no longer so vastly superior to the technology of other nations in many product areas. We are in effect in a technological race with a great many of the European nations and Japan. Our concern in the Department of Commerce with the promotion of export trade has made us very sensitive to the fact that the slightest hesitation in our ability to produce at high quality and low cost could be painful indeed in the competitive sense. Our construction and mining machinery industry, for example, exports 34 percent of its total production simply on the basis of the present technological superiority of the product. The automobile maintenance equipment industry exports 38 percent for similar reasons. But we know that a nation such as Germany is constantly improving its production technology to meet problems of a tight labor market, and that this constantly endangers our competitive edge in these, as well as in many other, industries.

We know that certain key industries in this country have been exceedingly slow in building on or implementing new technology currently available to them. Even within industries there appears to be a wide divergence in the progress of firms. We have collected data for a few selected industries that show that in many cases the productivity of the more efficient firms may be as much as two to four times that of the least efficient ones. Indeed, we have found that the productivity of the less efficient firm in some industries is perhaps only 40 to 60 percent that of average in the entire industry.

Let me expand on this for a moment. What we have brought together is data for a few industries on the value added per employee during the year 1958; value added is, roughly speaking, the value of shipments less the cost of materials. Value added per worker among the plants in an industry is a crude index of efficiency, although it may be influenced by some other factors as well. We found, for example, that in the motor vehicles and parts industry value added per employee ranges from $6,680 to $23,470, with $11,960 for the industry as a whole. Hence, the more efficient establishments may have a productivity twice that of the average and 3.5 times that of the less efficient plants. If these less efficient plants wish to match the most efficient in their industry, they would have to increase productivity as much as 252 percent. Even in the metal-cutting machine tool industry, which is one of our more efficient industries, we have found that about 10 percent of the plants would have to raise their productivity about 137 percent to reach the level of the more efficient plants.

These data suggest that many firms in this country are not using the latest production methods. It raises in my mind the serious question of how much unemployment has been created in particular industries, not by the introduction of new technology, but by the failure to introduce new technology and thus keep a firm alive.

The proposed Commission could examine a wide variety of problems which reasonable men could define as they view the future of this Nation. For example, how can we determine what is the best allocation of talented scientific people among space, defense, education, and private activities?

Can new technology help us solve some of our pressing problems in the field of transportation?

Are we applying all the technology we should in overcoming the limitations on our present sources of energy and power?

Can technology be of greater assistance in the modernization of our cities?

Is our educational system fully suited to our age of technology?

Should we do more both through Government and through private trade associations to urge lagging firms to introduce newer production techniques and to modernize their equipment?

Would it not be in the national interest to develop a more extensive "early warning system" which would signal the introduction of new technologies and of whole new industries, especially if they replace established industries?

How can we provide American industry with more advanced knowledge of new technologies developed abroad?

What would be the results if we could identify the implications of impending technological changes on community development programs—on the plant and business location factors, on the recreational and health needs, on housing needs, and on the transportation needs?

Would it not be useful if we could develop information on the age and performance of industrial and commercial equipment currently in use and the state of diffusion of new techniques in each industry?

These are the kinds of questions that the Department of Commerce would like to see this Commission consider. It may well be true that we have always had disparities in our economy, for we progress not in a straight line but in a series of jagged steps as we reach forward, adjust, and reach forward again. It is certainly true that we have always had technological change and the resulting problems from it, but in my view it has never before been so incumbent upon us to seek solutions to these pressing problems so that we can continue to grow and prosper, not in any one segment of our economy and society, but for the benefit and well-being of all.

I look forward to the prompt establishment of this National Commission because we are deeply concerned with the questions I've raised; because the Department of Commerce is responsible for promoting the use of technology for economic growth and development; and because the President has directed my Department to explore new ways by which the Federal Government might join with private business and our universities to speed the development and spread of new technology.

Secretary HODGES. I should like to say, Mr. Chairman, I appreciate the chance of being here with Secretary Wirtz, and of testifying on this bill, as we have done before the House. We all know the Nation is facing a real dilemma. On the one hand, we must have technological change. Some people have said there is no choice. You must have automation. It is just a question of how do you handle it when you get it?

This bill will provide a charter for our Government and for the members of the Commission to sit down in calm deliberation and try to work on this important subject. There are other committees already mentioned in bills, and discussed in the Government, but I think this particular commission we are talking about would probably coordinate all the rest of them to a point where we would have a deliberative discussion on the part of these 14 people.

This bill provides for a Federal Interagency Committee, which would assist a commission of informed private citizens by making available to them all the resources of the various governmental agencies.

I notice, as we have discussed previously, section 6 of the bill currently reads that the Interagency Committee Chairman will be the Secretary of Labor, and I would like to draw your attention to a change that was made in the clean House bill 11611, which upon the recommendation of the Secretary of Labor was amended to read that both the Secretaries of Labor and Commerce would have a joint chairmanship here.

Senator CLARK. Mr. Secretary, as I understand it, however, the principal impact of the bill is to create a commission of 14 members appointed by the President with the advice and consent of the Senate,

among persons entirely outside the Government, and the Interagency Committee to which you refer is merely advisory to this Commission. Is that right?

Secretary HODGES. That's right. That is correct, sir.

In connection with the cochairmanship of this Committee, I would like to suggest an amendment to section 9, which now provides the Secretary of Labor shall furnish administrative services. It is probably better if you have both Departments, Commerce and Labor, furnishing them, but if it would make it easier for you in handling it with the other House not to do that, we can work the thing out together.

Senator CLARK. Now is this cochairmanship acceptable to both you and Secretary Wirtz?

Secretary HODGES. The Secretary of Labor, as he will tell you later, recommended in the House that it be made a joint chairmanship. We do serve as joint Chairmen of the President's Labor-Management Advisory Committee, he serving last year, and I am taking on this year as of the 1st of July.

Two other changes have been made in the clean House bill which I am pleased to endorse. First, the name of the Commission has been changed from "National Commission on Automation and Technological Progress" to "National Commission on Technology, Automation, and Economic Progress." This larger scope seems better to us.

Secondly, the original bill provides for recommendations by the Commission as to administrative and legislative steps to be taken by the Federal Government. The clean bill provides that the Commission shall also recommend administrative and legislative steps to be taken by State and local governments. I would endorse this approach, having long felt that the local environment must be receptive to economic adjustment if Federal programs are to be successful.

And I would like to endorse that particularly, because I think that we ought to have the State and local government's interest. We called a meeting some time ago of the representatives of all the States to discuss this, and I would like very much to see this carried out.

Now we have made, and I should like to recount them now—the Labor Management Committee, which Secretary Wirtz and I have the honor to chair jointly, has made—certain recommendations in connection with this. They have recognized that automation is a necessary thing, but they also say that we must pay some attention to the human side of it.

Productivity growth in the economy as a whole is the source of most of our wealth, and therefore, we want to look further to more productivity.

Business will look to this Commission to advise us on means of promoting technological advances, in order to increase this Nation's output of goods and services more and more efficiently for the benefit of our overall standard of living.

I would just like to emphasize, Mr. Chairman, that I think we ought to take this positive approach of getting a greater, higher standard of living and greater growth in our economy, at the same time recognizing the social side of it. I am confident that we can see a breakthrough on this.

I would just like to point this out, Mr. Chairman and gentlemen: That we are not now running as far ahead or as fast ahead of the other nations as we once were. Following the war, we had a little advantage. Now they are picking up much of this technology and automation, and I think that we are going to have to, particularly in our exports and our world trade, do as much as we can to try to stay ahead of these other nations, if we are going to compete.

I would like to point out something to you and comment on it just a minute, before I finish, that exemplifies that it isn't a question of not knowing in many cases what to do. We have found that the productivity of the less efficient firms in a single industry varies sometimes as much as 40 to 60 percent of the average efficiency of that industry, and it may be over a hundred percent difference from the top efficient firm in that industry.

Let me expand on this for a moment. We have made a study, and are bringing it up to date now, of the value added per employee—that is value of shipments less the cost of materials. We have found that in the motor vehicles and parts industry, which is for the most part fairly modern, value added per employee ranges from $6,680 to $23,470, with $11,960 the average.

Therefore, you see, the more efficient establishments have a productivity twice that of the average, and three and a half times that of less efficient plants.

If these less efficient plants wish to match the most efficient, in their industry, they would have to increase productivity as much as 252 percent.

Even in the metal-cutting machine tool industry, which is one of our more efficient industries, we have found that about 10 percent of the plants would have to raise their productivity about 137 percent to reach the level of the more efficient plants.

We want to point these things out, that we can do a lot with what we already have, and get the emphasis on the part of an objective citizen's committee for using and dispersing the information we have.

Take all the technical knowledge we get through our defense and space industry. If we can find some way of reaching the small and average businessman in industry, that would be very helpful. So, I would like to close by raising a few questions.

The proposed Commission could examine a wide variety of problems which reasonable men could define as they view the future of this Nation. For example, how can we determine what is the best allocation of talented scientific people among space, defense, education, and private activities?

Can new technology help us solve some of our pressing problems in the field of transportation?

Are we applying all the technology we should in overcoming the limitations on our present sources of energy and power—coal, and the atomic development, and all the rest?

Can technology be of greater assistance in the modernization of our cities?

And is our educational system fully suited to our age of technology?

Should we do more, both through Government and through private trade associations, to urge lagging firms to introduce newer production techniques and to modernize their equipment?

Would it not be in the national interest to develop a more extensive "early warning system" which would signal the introduction of new technologies and of whole new industries, especially if they replace established industries?

How can we provide American industry with more advanced knowledge of new technologies developed abroad?

What would be the results if we could identify the implications of impending technological changes on community development programs—on the plant and business location factors, on the recreational and health needs, on housing needs, and on the transportation needs?

Would it not be useful if we could develop information on the age and performance of industrial and commercial equipment currently in use and the state of diffusion of new techniques in each industry?

These are the kinds of questions, Mr. Chairman and gentlemen, the Department of Commerce is particularly interested in, and we think that both Commerce and Labor have responsibilities to look at this thing from the standpoint of where this country is going in its economy; how can we take care of our people as a whole; how can we compete abroad; and I think the benefit of advice of a distinguished national commission under your direction would help us reach some of these conclusions, sir.

Senator CLARK. Thank you very much, Mr. Secretary.

Senator Randolph?

Senator RANDOLPH. Not at this point, sir.

Senator CLARK. Mr. Secretary, there are a couple of points I would like to raise. We have a letter from the Chamber of Commerce of the United States, commenting on S. 2623, which, although it was introduced by Senator Hart, I think is known as an administration bill; is it not? And I will ask you to comment on the points that the chamber of commerce, speaking through its legislative general manager, Theron J. Rice, made?

They say first, Commission representation should be equal as between management and labor. Since the Commission will be composed of 14 members, 5 members should be selected from industry, and 5 from labor organizations; 2 members should be experts in the field of science and technology, preferable academic members; and the remaining 2 members from the general public.

Could you comment on that?

Or, perhaps you would rather comment on these suggestions of the chamber of commerce later and in writing.

Secretary HODGES. I would be very glad to do that, to get a list of them, and give a little more time to it. I think that instead of tieing it down in the bill, I think, any general direction saying the Commission shall be representative would be enough in the bill, and leave it to the President to express it in his appointments, because I think he could then do the kind of things that would be necessary here.

Senator CLARK. I am going to suggest that the staff furnish you a copy of this letter from the Chamber of Commerce, and as soon as may be—because we do want to take up this matter promptly in executive session—you let us have your thinking.

Secretary HODGES. All right. We will be glad to do that. We will be glad to have that comment, also.

Senator CLARK. And similarly we have, from Mr. Emile Benoit, who, as you know, has done a great deal of work in this general employ-

ment and technological program, at the Graduate School of Columbia University, some additional situations which I would like to get your comments on, too.

Secretary HODGES. All right, sir.

(The information requested follows:)

GENERAL COUNSEL OF THE DEPARTMENT OF COMMERCE,
Washington, D.C., July 9, 1964.

Hon. JOSEPH S. CLARK,
Chairman, Subcommittee on Employment and Manpower, Committee on Labor and Public Welfare, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Enclosed is corrected transcript of Secretary Hodges' testimony on July 6 before your subcommittee on S. 2623.

During the course of Secretary Hodges' testimony you requested our comments on suggestions for amendments to the bill made by the U.S. Chamber of Commerce and Emile Benoit in their letters of June 29 and June 4, respectively.

The chamber recommendations and our comments are as follows:

1. There is recommended a fairly rigid allocation of Commission members to various groups. We believe the provision included by the House committee in its reported bill H.R. 11611, that management and labor be equally represented with at least two members each meets one of the chamber's chief objectives, that is, assurance that labor and management will be represented and neither will dominate the other on the Commission. Insofar as the chamber's recommendation for allocation of membership to other groups is concerned we feel maximum flexibility in the appointing authority would be preferable.

2. The chamber recommends a change in the name of the Commission. Aside from the question of mentioning "automation" the chamber's recommendation has been substantially adopted in H.R. 11611. However, if your committee concludes that the recommended name change is desirable, we would have no objection.

3. With respect to subpena power, if you committee concludes that the Commission should have power to "request" rather than "require" attendance of witnesses and production of documents, we would have no objection to this chamber recommendation.

4. We believe that deletion of the Federal interagency committee as recommended by the chamber would be most unfortunate. We believe that an important function of the Commission will be the correlation and analysis of a wealth of information and statistics already accumulated by Government agencies. The provision for adequate liaison between those agencies and the Commission will facilitate obtaining this information and will enhance its usefulness.

5. The authority to recommend action to State and local governments is contained in H.R. 11611 as reported.

6. A limitation of $2 million on appropriations is contained in H.R. 11611 as reported.

With respect to Mr. Benoit's recommendations:

1. Mr. Benoit suggests the abolition of salary limitations for Commission members. This seems unnecessary and undesirable.

2. Mr. Benoit's suggestion for an industry-labor advisory group would seem to be taken care of by the provision in H.R. 11611 as reported for equal representation of labor and management on the Commission.

3. With respect to "compulsion of witnesses," if your committee concludes that this is not needed, we would have no objection to providing that the Commission may "request" rather than "require" attendance of witnesses and production of documents.

4. Although we recognize the possibility that additional time may have to be allowed for the final report and that permanent policymaking machinery may prove to be desirable as Mr. Benoit suggests, we believe it would be preferable to postpone action on this recommendation until the Commission has been organized and has had full opportunity to assess the desirability of this suggestion.

Sincerely,

ROBERT E. GILES.

Senator CLARK. Now, Mr. Secretary, you will recall, because you testified, that this subcommittee has recently completed a very extensive study of the problem of unemployment in connection with automation, technological change, and cybernation, and the other

economic forces of invention which are in many ways causing a revolution in our manpower situation in the United States.

We have issued a pretty comprehensive report, with a good many recommendations. In the course of preparing that report, we called on you, on Secretary Wirtz, on a number of the other leaders in the administration, for your views.

I wonder if you could tell us what, in your opinion, this Commission could furnish to the press and the public which is not already made available in the report of the subcommittee.

And please be quite candid, and, if you choose to be, rude.

Secretary HODGES. Well, Mr. Chairman, I know that there are some possibilities of overlapping, as there is great interest on the part of many groups in this. Speaking specifically to this report, I would not be able, without looking at it again, to give you a conclusive answer. I think this Commission of distinguished citizens would do a job of coordinating the various recommendations that have been made both by your subcommittee and by labor, management, and others.

I think that is the chief virtue of it. We are always inclined to have overlapping, because with a subject like this, everybody gets interested in, people begin putting in bills, writing reports, and making comments.

I think that all of these, certainly including your report, will be helpful. But, I still feel that this Commission, properly staffed, taking a look at all of these, can come nearer giving us the kind of coordination and directing its suggestions to the agencies involved, particularly Labor and Commerce, that will give us a greater appreciation of and a greater control of the various recommendations that are made. That is my general statement.

Senator CLARK. Actually, a Commission of this sort probably would do just what you suggest, which is to coordinate work already done in the field, rather than doing a great deal of independent research and basic research of its own; would it not?

Secretary HODGES. I think so.

Senator CLARK. You are going to be dealing with members who don't have full time to give to it. They are working without compensation. What you really are wanting to do is to pick their brains, after they have had an opportunity of considering and coordinating the work that has already been done by others. Isn't that about it?

Secretary HODGES. That is right, and you would get not only the things you just read here from Professor Benoit and from the United States Chamber of Commerce, but also ideas that you are going to get from other people, and I think this Commission, looking at it objectively, not being tied down as those of us in Labor and Commerce, will give a very clear picture of what it's all about, what the problems are, particularly if you get comments from people from all walks of life out in the country.

Senator CLARK. It seems to me that the greater job that needs to be done here is the public education job. Not too many of even our leaders, and certainly not too many of our ordinary citizens, in my opinion, have a comprehensive understanding of the gravity of the problems which are going to be under consideration if this bill is passed.

Would you not agree with me that one of the primary jobs which could be done by an executive commission of this sort would be

to acquaint and to educate the general public in the conclusions which they might come to?

Secretary HODGES. I would agree thoroughly, Mr. Chairman, and I would like to add this: If this Commission could point out to our professional education groups all over the country as to what they need to do to get in line with, or be ahead of, our problems, it would be one of the greatest things that could happen.

Senator CLARK. Perhaps you saw this morning's New York Times. There was sort of a panic button pushed by the physicists, to the effect that there weren't nearly enough physicists being trained to meet the needs of our complex society.

This rather amused me, because at a hearing before our Manpower Committee a couple of years ago, the then head of the American Society of Physicists told us they don't have any concern, "There are plenty of physicists, we don't need any more," which is some indication of the rapid change which is occurring in our dynamic economy all the time.

I quite agree with you that the need for more adequate planning in the manpower field in connection with technology is a very important thing, indeed.

Senator Randolph?

Senator RANDOLPH. Senator Clark, I appreciate the opportunity of joining you in the questioning of the Secretary. I call attention to the Senate bill which is modified in the House measure, section 14. "Such sums as may be necessary"—that is in the Senate language—and we would have, according to the House bill which is in the process of being reported, not in excess of $2 million.

Mr. Secretary, would you comment on that figure?

Secretary HODGES. Yes, sir. It sounds to me as if it would be plenty. I don't think anybody knows, but I certainly would want to put a limit of some kind on it. That sounds very good. Secretary Wirtz may have a different point of view.

Senator RANDOLPH. It seems to me that the figure is too high, Mr. Secretary, and I just wondered.

Secretary HODGES. It seems to me it is quite adequate. That may be too much.

Senator RANDOLPH. Now, on page 4, the language of the Senate bill is, "The Chairman of the Committee shall be the Secretary of Labor," and it is proposed that the Secretary of Labor and the Secretary of Commerce shall serve as Cochairmen of the Committee.

You envisage no conflict by having Cochairmen? You believe that this will be a cooperative program?

Secretary HODGES. That is right, and that was so accepted in the House bill.

Senator CLARK. Will the Senator yield?

Senator RANDOLPH. Yes.

Senator CLARK. I think we ought to provide a proviso in there to the effect that the present incumbents shall continue to serve in the offices they now hold, and become Cochairmen.

Senator RANDOLPH. Mr. Secretary, some of us in the Senate have been brought rather abruptly to the problems in our own States caused by automation.

Secretary HODGES. Yes, sir.

Senator RANDOLPH. Some faced it in mining, some in manufacturing, and now to a greater degree, nationwide, in goods and services, not only automation, but cybernation.

I am wondering what your comment would be on the fact that in the 1965 fiscal year, we are going to spend, as a Federal Government, $165 million—I checked the figure—on the purchase of computers—nothing but computers.

Secretary Hodges. Yes.

Senator RANDOLPH. I wonder, would you comment on such a purchase?

Secretary Hodges. Without knowing whether or not it is a good, practical purchase, I would comment on the general proposition, that the Federal Government, if it is going to stay modern, will have to buy a lot of computers.

That is what is happening in all of the basic industries, whether it is banking or services or whatnot, so I would say that the basic idea is sound. I wouldn't comment on this particular purchase.

Senator RANDOLPH. Well, when I read of this purchase, I attempted to find what the displacement of manpower would be in the Federal agencies by the installation of these machines, and I will place that in the record, agency by agency.

Secretary HODGES. All right, sir.

Senator RANDOLPH. Thank you.

(The information requested follows:)

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., February 17, 1964.

Hon. JENNINGS RANDOLPH,
U.S. Senate,
Washington, D.C.

DEAR SENATOR RANDOLPH: As I informed you following our White House discussion of the subject, I asked my staff to obtain estimates of the number of Federal employees that might be displaced in fiscal year 1965 due to the use of electronic computers. The attached table gives these estimates.

We asked the agencies that will be using computers in fiscal year 1965 to supply their present estimates as to the number of employees the computers would displace. We asked for the number of displacements that would occur during the year and whether the computers involved were installed in 1965 or in earlier years. So that these figures can be viewed in relation to the overall change in the agency's employment, the attached table also indicates the estimated total employment for each agency as of the start and the end of the year.

The number of persons displaced does not mean that these employees will be dismissed by the agency. With few exceptions, displaced persons are assigned to other jobs. Often these reassignments involve better positions and better pay. Some are placed in new jobs in connection with the operation of the computers. Others are assigned to more important and more productive activities made possible by the use of the computers. Normal attrition within the agency makes it possible to place many in other positions that become vacant. A number are placed in new programs that are being undertaken. Still others are assisted in finding—or find by themselves—positions in other agencies where new programs or normal turnover make employment possible.

I don't mean to imply that displacement due to computer utilization is a minor problem. It is a very important problem for the employees and for the agencies concerned. However, the attention the agencies have been giving to it has greatly reduced the potential hardship on employees. The Bureau has underway a comprehensive study of the general management of automatic data processing equipment in Government. The Civil Service Commission is making a related detailed study of the problem of personnel displacement in connection with the use of computers. The results of these studies should be available by the end of June. We hope the studies will reveal ways in which the Bureau and the Commission will

be able to give the agencies greater guidance and assistance in alleviating the adverse effects of personnel displacement.

Sincerely,

KERMIT GORDON, *Director.*

Displacement of personnel during fiscal year 1965 due to the installation of electronic computers

Department or establishment [1]	Number of persons to be displaced in fiscal year 1965 only			Estimated employment level as reflected by the fiscal year 1965 budget			
	Due to computers installed during fiscal year 1965	Due to computers installed prior to fiscal year 1965	Total fiscal year 1965 displacements	On June 30, 1964	On June 30, 1965	Change	
						Increase	Decrease
Interior Department	0	67	67	72,592	72,774	182	
Tennessee Valley Authority	0	1	1	18,041	17,650		391
State Department	0	12	12	25,324	25,320		4
Agency for International Development	0	7	7	16,500	15,700		800
Agriculture Department	0	54	54	116,800	115,376		1,424
Veterans' Administration	0	55	55	172,821	173,554	733	
Railroad Retirement Board	0	85	85	1,920	1,871		49
Social Security Administration	0	367	367	35,701	36,347	646	
Commerce Department	11	0	11	34,603	34,945	342	
Small Business Administration	6	0	6	3,490	3,490		
Federal Home Loan Bank Board	15	0	15	1,323	1,323		
Housing and Home Finance Agency	0	37	37	14,186	14,894	708	
Treasury Department	0	717	717	88,100	90,090	1,990	
Post Office Department	300	80	380	593,100	597,900	4,800	
Federal Communications Commission	0	7	7	1,600	1,650	50	
Securities Exchange Commission	10	0	10	1,468	1,531	63	
Federal Aviation Agency	260	0	260	46,400	46,450	50	
Subtotal, civil agencies	602	1,489	2,091	1,243,969	1,250,865	9,564	2,668
Department of Defense	0	2,050	2,050	1,007,000	989,920		17,080
Grand total	602	3,539	4,141	2,250,969	2,240,785	9,564	19,748

[1] Only agencies reporting displacements are listed. Numerous agencies using computers anticipate no displacements during fiscal year 1965. Included in this group are the 3 big users; viz, Atomic Energy Commission, National Aeronautics and Space Administration, and General Services Administration.

MARCH 2, 1964.

Hon. KERMIT GORDON,
Director, Bureau of the Budget,
Washington, D.C.

DEAR DR. GORDON: Thanks for your comprehensive letter of February 17 transmitting the useful and revealing compilation on displacement of personnel during fiscal year 1965 due to installation of electronic computers.

Be assured that I am appreciative of your cooperation and of the thoroughness which is apparent in the report which you have provided as a consequence of our conversation following the White House briefing a few weeks ago.

In spite of the impact of the computer installations, your letter is reassuring.

As one cognizant of both the benefits of and the problems created by automation, I find encouragement in your assurance that "a comprehensive study of the general management of automatic data processing equipment in Government" is underway in the Bureau of the Budget. It is equally encouraging to be informed that "the Civil Service Commission is making a related detailed study of the problem of personnel displacement in connection with the use of computers." I hope that the results of both of these studies will be made available to the Subcommittee on Employment and Manpower of the Committee on Labor and Public Welfare, and to the Committee on Post Office and Civil Service

as well. As you know, I am a member of those groups and am acquainted with their interest in this subject.

With appreciation and best wishes.

Sincerely,

JENNINGS RANDOLPH.

Senator CLARK. Thank you very much, Mr. Secretary. We appreciate having you with us.

Secretary HODGES. Mr. Chairman, I forgot to introduce my associates. With me are my General Counsel, Mr. Giles, and the Assistant Secretary for Economic Affairs, Mr. Holton.

Senator CLARK. We are very happy to have them with us this morning.

Now, Mr. Secretary Wirtz.

STATEMENT OF W. WILLARD WIRTZ, SECRETARY OF LABOR; ACCOMPANIED BY EDITH N. COOK, ASSOCIATE SOLICITOR, AND LEON GREENBERG, ASSISTANT COMMISSIONER FOR PRODUCTIVITY AND TECHNOLOGICAL DEVELOPMENT, BUREAU OF LABOR STATISTICS

Senator CLARK. Secretary, we are happy to have you back before the subcommittee. You are getting to be almost a professional witness before us, and I note that you have, too, a prepared statement, which I would like to have printed in full in the record at this point, and then ask you, if you are agreeable, to give us the summary of your views.

(The prepared statement of Secretary Wirtz follows:)

PREPARED STATEMENT OF W. WILLARD WIRTZ, SECRETARY OF LABOR

Two weeks ago when appearing before this subcommittee I described the three new great pieces of legislation, the tax, civil rights, and war against poverty bills, as reflecting a new vision of the American opportunity—the American dream, if you will.

This vision, this dream, can become a reality and not a hollow mockery if we face squarely today the tremendous economic and social possibilities, for both good and evil, of our onrushing technology.

The National Commission on Automation called for by S. 2623 is designed to help do just that. The subject matter of its mandate is nothing less than the future shape of the economic world and our daily lives, our level of living, our industries ability to compete in world commerce, the strength of our national defense, and, in a very fundamental sense, the viability of democracy.

Automation and other revolutionary technological advances can be the key to unlimited economic opportunity. They can make real the dream of ending poverty.

At the same time, these developments include forces which if left unchecked can cause hideous blemishes in our society.

Unfortunately the history of economic progress is not always a story of progress for all. Economic progress, overall prosperity, is essential, and the maximum use of new discoveries is a vital part of such progress. But it is not enough. The real issue is not how far or how fast we are advancing on the whole, or on the average; it is how many people are being left out.

Too many people are being case aside, being left out, today, by the revolutionary technological changes which are taking place. There is no need for this, and we cannot permit it to continue.

It is important that "the public"—in the broader sense which distinguishes it from "the Government"—be involved in the development of a program designed to apply our new discoveries for the benefit of economic progress without leaving those displaced to bear the burden of adjustment.

The proposal for a National Commission on Automation has been conceived around three central objectives:

First, to identify technological trends over the next 10 years and appraise their economic, employment, and social effects.

Second, to access how technological advances can be channeled in directions where they will promote both economic and social progress and aid in fulfilling unmet community and human needs.

Third, to recommend the governmental and private action which should be taken to (*a*) promote technological change, (*b*) facilitate occupational adjustment and geographic mobility, and (*c*) prevent and alleviate the adverse effects of change on displaced workers.

The revolutionary nature of much of science and technology today is evident.

The magic of electronic computers is well known. They were originally developed primarily for military and scientific purposes during and after World War II. Then they were slowly adapted for civilian use. These great "brain" machines have been hailed as the salvation of overworked clerical staffs, and decried as a dire threat to the jobs of white-collar workers.

There is no doubt that these great machines are a force for good. Without them we would have no earth satellites and no guided missiles. They can remove the drudgery of human processing of vast amounts of complicated and technical data.

The first computer was introduced into commercial use only 13 years ago. Yet is it estimated that about 18,000 general-purpose digital computers are now in operation—in a great and increasing variety of business, industrial, and scientific uses. Automated systems control increasing numbers of plants in the chemical, petroleum, electric light and power, and other industries; and computers are being installed for data processing in steadily widening areas of business and government.

Laser beams are another amazing development, with both military and social uses. They involve essentially the conversion of light waves into coherent, high-frequency energy beams that create temperatures higher than those of the sun's surface.

Though still in its infancy, laser technology is already the subject of extensive research and development work in such diverse fields as medicine, chemistry, communications, space exploration, data processing, and national defense.

A laser has already been used as a surgical instrument in operating on the human eye.

In chemistry, laser beams are expected to create reactions never before achievable, and to provide a new tool for controlling processes.

Potential applications are already foreseen also in guiding missiles and spacecraft, machining metals, making geodetic and weather measurements, transmitting power in space, and offensive and defensive weaponry.

In metalworking, a major development is numerical control—a way of controlling machine tool operations by tapes. In some advanced examples, a whole group of tools are combined into a machining center. One operator can perform all the maching steps needed to complete a part. Labor requirements per piece, for machine tool operators, machinists, and tool and die makers, could be substantially reduced. Although numerical control has advanced furthest in the machine tool field, it is also applicable to inspection, welding and drafting.

In the field of communication technology, far-reaching achievements are greatly enlarging man's ability to overcome barriers of distance and time in transmitting and receiving information. The most spectacular is the communications satellite which, according to David Sarnoff, in the May 1964 Fortune, opens the way technically "for the establishment, over the next few decades, of a communication system by which governments, organizations, or individuals may establish contact with anyone, anywhere, at any time, by voice, sight, or document, separately or in combination."

When linked with television and with increasingly automatic telephone operations, the satellites could have a marked effect on employment opportunities—possibly opening up new jobs for engineers and technicians and reducing the need for operating employees and some types of maintenance and installation workers.

These are only examples of what can and needs to be done to apply the infinite variety of technological developments not only to military and defense purpose, but also to civilian use and the advancement of human welfare. Here is one great task on which the proposed Commission can shed light.

We know we cannot stand still. The rest of the world is on the move and we must move with it, ahead of it. This country's technological and production skill is basically responsible for the high standard of living we enjoy today. It has enabled our industries to pay high wages and still meet foreign competition in our own and world markets. Yet this traditional resource—our advantage in production skill—has been shrinking.

Many illustrations of foreign technological leadership could be cited. In the glass industry, for example, a revolutionary new development in the flat-glass process originated in England which produces plate-quality glass at reduced cost. Plants utilizing this process have been under construction in the United States during the past year by two companies holding licenses for the process.

Reports have been received also from experts visiting Europe of highly advanced technology in such diverse fields as food processing, mechanization of materials handling, and automated trains. Similarly, the Japanese have made technological strides in a variety of fields, including textile and electronics manufacturing and the automation of ships.

Experts do not believe—and I do not mean to imply—that the United States has been outclassed in total production skill. But we do not have as great an edge of advantage as we once had.

This, too, suggests a vital task for the Commission.

There is need for continued and intensified efforts to achieve technological progress—not only in industries and plants which are now laggards in this respect but even in such technologically leading industries as electronics, where unremitting effort is required to keep up with the continual rapid advance in technology.

We also know from industries which have long been subject to change, that technological advances can have drastic effects on workers by reducing the number of jobs and changing their nature.

We are all too familiar with the effects in the railroad industry—a 50-percent drop in employment between 1947 and 1963, with more to come.

We are all also familiar with the drastic decline in agricultural jobs—from 8.3 million in 1947 to 4.9 million in 1963, a drop of over 40 percent.

As a moral and humane society we must make sure that where workers are displaced by technological advances they are not left to bear the burden alone but are given help to make the necessary adjustment.

The Commission called for by S. 2623 will make recommendations for action in this area.

In addition, our country's great unmet needs constitute a challenge to our technical and social ingenuity, with which the new Commission must be deeply concerned. Whether our children and our children's children will find this country a tolerable place in which to live will depend, in large measure, on the progress we make today and tomorrow in solving such basic problems as our increasing water shortage (whether by desalinization of sea water or other means); the pollution of the rivers and atmosphere; and the problems of mass transportation, housing, and community facilities which threaten the future of our ever-expanding metropolitan areas.

In all these fields, the contributions of engineering and the natural sciences can be as important as those of the social sciences. The Commission can perform a unique service by bringing together experts from both these groups to study these fundamental problems.

The Commission's investigations can have a scope well beyond that of more specialized research efforts by governmental and private research organizations and can yield a perspective not provided by these separate programs.

I call your attention to the amendments in the bill as reported by the House Education and Labor Committee, H.R. 11611. We have no objection to these amendments. I particularly recommend the amendment which makes the Secretary of Commerce Cochairman with the Secretary of Labor of the Federal Interagency Committee provided by section 6 of the bill. The Secretaries of Labor and Commerce now serve as Cochairmen of the President's Committee on Labor-Management Policy. Their working relationship on this Committee, and in fact, throughout this administration has been productive and harmonious. This relationship has been particularly close in dealing with matters in the area of automation and technological change.

In conclusion, I emphasize the conviction that the study and recommendations of a high-level national Commission will command a degree of public attention and acceptance which no report or recommendation stemming from an individual agency of Government or from a private organization could achieve, and will thereby aid greatly in developing a unified national purpose in this critical area.

The Commission's report will provide a base from which we will be able to move to higher levels of effectiveness with programs to promote economic and social progress and justice and to achieve full employment.

We are privileged to live in a time of unprecedented challenge, and of unparalleled hope. As a nation we have taken rightful pride in our proven ability

to meet new demands, to welcome new ideas, to pioneer in new and creative solutions to the problems which accompany progress.

The Commission proposed by S. 2623 will greatly aid the Nation to rise to the challenge we face today. President Johnson has said, no later than June 23, that enactment of this bill is imperative. I urge that it be established as quickly as possible to get on with this vital task.

Secretary WIRTZ. Thank you very much, Mr. Chairman. I should be grateful for the opportunity to file the statement, to summarize it very briefly, and then to answer whatever questions there are.

There are with me today, Mr. Chairman, and members of the committee, Miss Edith Cook, Associate Solicitor for Legislation of the Department of Labor, and Mr. Leon Greenberg, Assistant Commissioner of the Bureau of Labor Statistics.

Senator CLARK. We are happy to have both of you with us.

Secretary WIRTZ. As for your comment about the professional witness, I trust that this is not one of the two professions or functions in the world in which the amateur has an advantage over the professional.

The subject is one which we have discussed here, so frequently, Mr. Chairman, and members of the subcommittee, that I suppose I run the peril of repetition on almost anything I might say. That is only another way of expressing again the appreciation of the administration, and, if you will, of the country, to the members of this subcommittee for having taken the lead in the development of a whole manpower program.

I don't believe I exaggerate a bit in saying that I think we are probably 2 or 3 years ahead in the development of a manpower program as a result of the work of this committee, and the parallel committee in the House, and I simply want to express the appreciation of all concerned for that.

Senator CLARK. Well, I know my colleagues appreciate your kind words, but I would like with great sincerity to say that I don't think we could have gotten out of the batter's box, if it hadn't been for the cooperation we got from the Department of Labor and the Secretary in all of our work.

Secretary WIRTZ. Thank you very much.

Now, with respect to the particular bills before you, the two to which you refer, Senate 2427 and particularly, Senate 2623, I should like to say only these things. This brings us again face to face with the possibility that developing technology in this country can be either of two things.

It has almost a Dr. Jekyll and Mr. Hyde personality. It can be a terrible curse as far as the development of the country is concerned, but only if we fail to take advantage of the opportunities which it presents. It can be, on the other hand, the instrument which permits man to take advantage of his own wisdom and permits him, if he has the understanding which goes along with wisdom, to open up all of the possibilities which science presents to him.

I should like to emphasize the point that I think we have come to the realization, in the last 2 or 3 years, particularly, that it doesn't do us any good to measure progress or try to measure progress, on an aggragative, or overall basis. Rather we should try to determine how many people are included, and how many people are left out, of whatever gain takes place. So we come to the proposal to develop a commission of this kind, as another attempt to solve the equation

of technology, to see to it that it works for people's advantage and benefit, rather than to their disadvantage.

You commented earlier about the speed at which these things are taking place. It came as something of a shock to me to discover that the first computer—and you referred to the computers which are being purchased—the first computer was used commercially only 13 years ago, and the whole development, as far as the computer is concerned, has taken place in 13 years.

Senator RANDOLPH. It is outmoded now, isn't it?

Secretary WIRTZ. Oh, yes, the original ones are in the museum, already. This year, there are 18,000 of them installed, one place or another. Then you look at the most recent development, which is, I suppose, the use of the laser beam, which can do everything from tear down a building to perform a delicate operation on the human eye by the energizing of a light beam and the creation of heat hotter than the heat on the sun's surface. You realize just from these illustrations and from the few others which I refer to in my statement how fast the whole thing is going.

I was thinking coming over this morning of James Thurber's counsel that man is simply going too fast for a world that is round, and that some day there is going to be a great rear-end collision, and man isn't going to know until too late that what hit him from behind was man.

I take it it is the function of this committee, it is the function of the Departments of Labor and Commerce, and it will be part of the function of this commission, envisaged by this bill, to see that that does not happen, and there is no reason in the world why it should happen.

Senator CLARK. One of the things that frightens me grows out of my reading a couple of weeks ago a book by Dr. George Gallup, the well-known pollster, acting in a somewhat new role, and suggesting that man is only beginning to appreciate the capacity of his own mind, and that we are only using about, perhaps, one one-hundredth of our mental ability to solve the problems which confront us.

If we suddenly got to using 50 or 75 or a hundred percent of it, I am afraid we would be in even worse shape than we are now. With the computer and the undeveloped potential of man's mind, we are moving pretty fast, and faster every day. You think back in the last 13 years, it is fantastic to me what has gone on in the area under general consideration which will be under consideration in this Commission, if the bill is passed. I am sure you have seen it since you have come to the Labor Department.

Secretary WIRTZ. Yes, and yet in your saying that, I know that you suggest only the sharing of an excitement about this whole thing.

Senator CLARK. That's right.

Secretary WIRTZ. We would face not only economic stagnation, but I am sure ultimate boredom, if it weren't for the pace at which things are moving, and it is only if we are reckless about the misuse of them that we face any problem.

I agree so completely with Secretary Hodges in pointing out that these developments are essential to the promotion of the standard of living in this country. All of these things are necessary, but it is becoming clearer every single day that the economy is moving along lines which could leave out a tremendous number of people, if we don't handle it correctly.

Senator CLARK. Don't you feel in your own experience an accelerating rate of new developments in this whole technological field, and don't you share my fear that the social sciences will not be able to keep up with the enormously accelerated progress which appears to be being made in national physical sciences every day?

Secretary WIRTZ. I do. I have no sympathy with the suggestions that technology is simply another phase in the developments that goes clear back to the introduction of the wheel. It seems to me that our knowledge is right now, developing, if you will, geometrically, while our understanding is developing arithmetically, to use another figure of speech.

Wasn't it Solomon who said that we must have wisdom, but above all, we must have understanding? Our wisdom is developing right now faster than our understanding. And we have got to catch the one up with the other.

Senator CLARK. Just for the record, the book of Dr. George Gallup to which I made reference is entitled, "Miracle Ahead." I commend it to the audience.

Secretary WIRTZ. Secretary Hodges referred to the advancing pace of technological development in the rest of the world. I simply want to reaffirm what he said. I don't think it is true that technology is out in front in the rest of the world of what it is in this country. In fact, quite to the contrary. But there is no question about the fact that the gap is narrowing, and that we have lost some of our monopoly of wisdom, if you will, some of our monopoly of technological understanding which was one of our resources.

I think that is good. Because what it means, among other things, is that there will be developing markets abroad for the things that we produce in this country. That is only one aspect of the fact that in my understanding of it, advancing technology is absolutely essential to the achievement of full employment.

Senator RANDOLPH. Secretary Wirtz, a comment at that point, in connection with the export-import problem, in the overall.

Secretary WIRTZ. Yes, sir.

Senator RANDOLPH. We have been able in the past to compete against the foreign manufactured goods that moved into commerce in this country. Our wage scales were at a certain figure, and wage scales of those countries were at a lower figure. They could move products into the United States and undersell our manufacturer.

However, we had the know-how; they didn't have it. Now they have gained the know-how over there, and they have higher wage scales.

What is the balance? Has this helped or hindered, in the free flow of goods?

Secretary WIRTZ. I think it helps, Senator. The problem is beyond my understanding, frankly, and mastery, as a matter of abstract economics, and I just don't understand it.

I do understand this much: that in order to achieve full employment in this country, we have got to expand our exports, and we can't expand our exports without their being a development of the economies of these other countries so that they can buy these things from us.

Our studies, to the most precise point I can report them to you, suggest that there is probably a 4- or 5- or 6-to-1 ratio of importance as between exports and imports, in terms of jobs; or putting it this

way: Our export potential is, in our understanding of it, six times as large in terms of jobs as the loss which we will suffer from imports.

I don't think that it can be a one-way street. We can't increase our exports without accepting some imports, but as nearly as we can figure out, the potential ratio is about 6 to 1. But I would like to add this: I think the only way that we can maintain a higher standard of living in this country than in the rest of the world—especially with the world shrinking as it is economically, until now nations are closer together than county seats used to be in terms of time—is by keeping ahead technologically.

If we simply slowed up on our technological development, while other nations went ahead, I assume that we would lose the only basis on which we have been able to maintain an advantage as far as standard of living is concerned. We could not shut out the rest of the world, as far as its exports or our imports are concerned.

They would immediately shut off our exports, and I say, I think we would lose on about a 6-to-1 basis on that, so my answer to your question—I am sorry it is so long—my answer to your question is that we must continue to move ahead rapidly in terms of technology development, in terms of efficiency of production, in terms of a mixture of ideas and ideals, in order to compete with the rest of the world. I am fairly confident that we have got a substantial leadtime right now in that race.

But it is—excuse me.

Senator RANDOLPH. I will press the point just a little further, because we do have quota systems on certain imports. You wouldn't advocate doing away with those, would you, summarily? There are problems that have to be settled.

Secretary WIRTZ. No, I would not. I think particularly of the cotton textile matter which has been very much before the Congress and the administration the last 2 or 3 years, and with respect to which I had some part in working out a quota arrangement in 1961–62.

I have in mind, too, the problem of the relationship of coal production, for example, and the importation of residual oil. There are a number of other fairly direct relationships between imported products and domestic production. I think we have got to look at each one of those in individual terms.

There is provision for that in the Trade Expansion Act of 1962. I think the Congress worked that matter out very carefully.

I look forward to the increased strengthening of the economy of the country, and of the world, in the Kennedy round of negotiations at the GATT. I would answer your question negatively. I would not consider any wholesale rejection of the kinds of protection which are involved. I think that we do have to explore a changing balance of exports and imports, a developing balance of exports and imports, frankly, in our own self-interest.

Senator RANDOLPH. Mr. Chairman, I appreciate the Secretary commenting on something that appears just a little afield, but it is actually closely related to this subject. In a State such as West Virginia that produces bituminous coal, and where the manpower was reduced tragically, in some instances, too quickly by the mechanization within the mines, our economy was struck another blow by the importation of a waste material, residual oil, from abroad. And so you had no cushion of time here, did you, to take care of this problem in the mining industry?

Secretary WIRTZ. It came too rapidly in the Appalachian area. I will put the precise figure in the record, but for purposes of discussion here, manpower in the coal industry was cut more than half in less than 10 years. Employment in the bituminous coal mining industry dropped from 436,100 in 1948 to 193,000 in 1958 and to 127,600 in 1963. And that's a movement, an industrial movement, which is bound to leave economic waste, deprivation, and poverty in its wake.

When it moves that fast, we have simply got to cope one way or another with the problems which it presents.

Senator RANDOLPH. Thank you, Mr. Secretary, for your realistic understanding of our problem.

Senator CLARK. Which, of course, Mr. Secretary, poses a very real problem for the States, such as Pennsylvania, which has large oil refineries, and some oil production. It is a very complicated matter. We have suffered from the enormous decrease in employment in the coal industry, but we also have our consumer interests, and our oil refineries to think about, and I am sure you agree with me it is a very complex problem. There is no easy answer.

Secretary WIRTZ. Yes, sir. Now, I think I will confine my remaining comments to some of the questions which have been raised with respect to the organization and the function of this Commission, as such.

I, of course, concur completely with everything that Secretary Hodges said about the chairmanship of the committee. I proposed personally at the hearings before the House that the cochairmanship arrangement be made.

I am less inclined at this point to think that any amendment of section 9 would be necessary, but I don't think it is an important matter. I just have the feeling that our experience with the joint administration of the President's Advisory Committee on Labor-Management Policy offers whatever evidence is necessary, and none, I think, would be necessary, of the cooperation which exists between the two departments. That is no problem in this respect any more at all.

With respect to the composition of the Commission, my answer to the question that you raised with respect to the suggestion of the chamber of commerce would be that the form in which the bill came out of the House, the clean bill, would permit the accommodation of that position, probably to the maximum extent advisable.

I don't believe that there is great value in emphasizing the institutional character of the membership on the Commission. As we have increasing experience with these public-private commissions, it seems to me one of the lessons is that we get the largest advantage from those, from the participation of those men and women who can rise above, if you will, institutional representation, and use their own best judgment in matters of this kind.

I call your attention to the fact that the clean bill from the House does provide that there shall be at least two labor representatives, and at least two management representatives.

There could be more, and it does seem to me that the form in which the bill left the House is probably the best form.

Senator CLARK. Let me say this, Mr. Secretary: My own view, subject to change, of course, for in the closing days of the session, we try to acclimatize ourselves, at least to some extent, to the views of

the other body, I personnally would rather see this wide open, the way the bill originally came down, because what we want, in my judgment, are experienced brains, without regard to where they come from.

Secretary WIRTZ. So would I, as a personal matter, Mr. Chairman, but it does seem to me that the House committee bill does permit an accommodation of the various views, and in the interests of simplicity, it seems to me to offer a good working basis.

Now, you inquired, too, as to the value of this commission, entering this field, where there has already been a good deal of work done, and my answer to that would be very much along the lines of Secretary Hodges' answer.

It is partly that there are additional emphases needed. It is partly that this problem is, as far as I am concerned, one in which the more attention given it by one group or another, the better off we are.

The problem of dealing with cancer—and I don't want to be misunderstood in making the comparison. I have in mind only this part of the comparison: That the problems of cancer are such that there ought to be duplicating, intensive research one place or another, to come up with the right answer.

Now, the difference between cancer and technology is that cancer is an unmitigated evil. Technology, on the other hand, only presents that possibility. What we are talking about is the necessity of guarding against the reckless use of technology, and on that front, I want to see as many people doing as many different things about it as possible.

But, in addition to that, the point which is presently left out in our program of dealing with technology is the enlistment of the public—in a sense which distinguishes it from the Government—in directing and focusing a great deal of attention on it. It seems to me a very good thing to have 14 outstanding public people working on this, along with the other groups which have it under consideration.

Senator CLARK. I would agree, Mr. Secretary, if you would agree, on the other hand, that this additional study is no substitute for action, and I would hope that the administration would consider next year, and very carefully consider, the legislative program we will initiate within this subcommittee based on our own rather comprehensive study.

We would not be confronted with the argument, "Well, we had better wait until 1966 to see what the Commission has to say."

In my view, this is a matter which would require continuous study for the foreseeable future, and I would question a little bit the desirability of having an ad hoc commission of this sort, which goes out of action, goes out of business in January of 1966.

However, we always have to meet the problem of creating another permanent agency, to which the Congress is usually pretty allergic. We are going to be faced with having to meet a continuing study of these programs, as long as you and I are around, aren't we?

Secretary WIRTZ. I assure you, Mr. Chairman, that we won't wait until 1966. I assure you of this from the realization that in the last—what would it be? 8 months?—through the efforts of the legislative and executive branches, action has already been launched.

The Manpower Development and Training Act has changed to meet a good many of the problems we are talking about here.

The tax bill was passed to invigorate the economy, to help meet the problems we are talking about here.

The Civil Rights Act is by no means unrelated, because it is to a considerable extent the Negro race which has suffered the impact of technology, and which is now protected by virtue of this Civil Rights Act, in some of its parts, against that onslaught.

There will also be the enactment of the poverty bill, I am confident, within the very near future.

And so I say to you that there seems to me complete evidence in the extraordinary, really fantastic record of action in the last 8 months, complete evidence that we are not going to wait for a commission to move ahead in this area.

We will, at the same time, be informed and advised by the work of this group.

Senator CLARK. I am glad that you take that position.

I will say I think that Secretary Hodges would have said the same thing, if I had the wit to think to ask him, but I do know also—and I am glad that you emphasized it—the enormous importance of the human factor in this bill and what's going to come out of it.

The bill, to be sure, does provide or on its first page, that it is imperative to identify and describe the impact of technology as an economic change on production and employment, including new job requirements, and the major types of work or displacement are technological and economic.

But, actually, this is a bill to help human beings, isn't it, and not merely just investigate the economy?

Secretary WIRTZ. That is correct.

Senator CLARK. Well, do you have questions?

Senator RANDOLPH. Mr. Chairman. It is my feeling that the Congress will pass this legislation before we adjourn. That, I am sure, is the position of the Senate, is it not, Senator Clark? That this measure will be brought to the Committee on Labor and Public Welfare, and reported to the Senate?

Senator CLARK. Insofar as the chairman has anything to say about it, the answer is "Yes." Of course, we have to consult our colleagues on the subcommittee as to their wishes.

Secretary WIRTZ. Would it be appropriate at this point, Senator Randolph, to make note, too, for the record, that as recently as June 3, President Johnson indicated his very strong feeling that this is one of the matters which should be completed at this session of the Congress.

Senator CLARK. Let me ask you this, Mr. Secretary, following along what we have just been discussing. This Commission comes to an end in January of 1966, under the bill. Do you think that is enough time?

Secretary WIRTZ. Yes, sir. I would put it under the pressure of a deadline. And I would like to say on the point that you inquired about earlier, I don't see how you can spend $2 million on this Commission, and wish that that point could be cleared up.

Senator CLARK. I don't, either.

Secretary WIRTZ. I call attention to the fact that the budget for the President's Advisory Committee on Labor-Management Policy has been $300,000 a year. Now, that may be too low, but I should

have some feeling that it is a mistake to put the $2 million in, not because it is too low, but because it seems to move it too high.

Senator CLARK. Would you be content with an authorization of half a million dollars?

Secretary WIRTZ. I would not be in a position to advise you responsibly at this point on that, and would be a little reluctant to do so. I will be glad to submit a statement for the subcommittee, being as specific about that as possible.

Senator CLARK. I wish you would do that at your earliest convenience.

Senator RANDOLPH. Mr. Chairman, there is no need for $2 million to put it at a top figure, is there?

Senator CLARK. I wouldn't think so.

Now, how would you in Labor, and how do you think the people in Commerce and the other executive agencies, deal with the continuous research and continuous appraisement which will be necessary after this Commission goes out of business?

Do you have the techniques, the staff, and setup to continue these studies?

Secretary WIRTZ. Yes, sir; we have, and I don't answer lightly. There has been the development within the Department of Labor, in the Bureau of Labor Statistics, in the Bureau of Employment Security, in the Office of Manpower Utilization and Training, and in the Policy Division, there has been the development of a fairly complete program to follow up in connection with this area.

Mr. Greenberg, who is here, has had a very large role in the development of that program. It includes quite a variety of inquiries and investigations of one kind or another—everything from surveys of one sort or another to currently an input-output study which should illuminate this situation a good deal.

In the Department of Commerce, you have the development of parallel, but in no way overlapping, agencies. There is the interest of the other offices of Government, and all of these things have been coordinated, as you know, recently by the establishment of an interagency manpower committee, in which a good deal of thinking, constructive, is going on about being sure that these various programs are interlocked.

I say, not lightly but deliberately, that there is the capacity to follow up on the kind of recommendation which should be forthcoming from this commission.

Senator CLARK. You will recall, Mr. Secretary, this was a matter in which the subcommittee went into pretty thoroughly in connection with our report. A number of alternate suggestions were thrown out there.

Perhaps in due course you will have some recommendations for legislation on which, of course, we want to get your thinking, when we are prepared to introduce them.

Does that complete what you wanted to say, sir?

Secretary WIRTZ. Yes. I think it does, except to reaffirm, in conclusion, the time factor that is involved in this, and I would like to do it with one statistic.

As nearly as I can figure out, we are piling up right now between 250,000 and 300,000 boys and girls on a human slag heap every year, and it is because we have not caught up with the adjustments which

are necessary to meet technological development. These are boys and girls who used to come out of school without an education and find unskilled work.

Now, the machines are taking over the unskilled work. I would just like to say, as emphatically as I can, that a conservative estimate, in my judgment, of the delay in meeting the problems of automation is that we are throwing away 250,000 to 300,000 boys and girls a year. If the country could understand this, I am sure it would prompt them to immediate action in this area.

I think the Commission will help in calling attention to that kind of problem.

Senator CLARK. And to supplement what you have just said, the inevitable result, it would seem to me, in human terms, is a substantial increase in human delinquency, because these people don't have jobs.

Secretary WIRTZ. The figure I give you is a figure which is a projection of the juvenile delinquency rates which are going up, the dropout rates which are not going up, but which——

Senator CLARK. Are not going down.

Secretary WIRTZ. (continuing). Continue, and in absolute numbers, they may be going up, and there are figures which are of even worse nature. I mean dope addiction figures, and that kind of thing. If the country doesn't wake up to what is happening to its boys and girls who can no lnoger get jobs because they don't have skills, it will find itself, well, in very bad shape.

Senator CLARK. Well, a lot of this comes from the hopelessness which overcomes them when they appreciate, because they don't have a trained skill, their chances of ever obtaining gainful employment are pretty slim.

Secretary WIRTZ. We have got to break the cycle—40 percent of the boys and girls who are the beneficiaries today of the aid to dependent children program are grandsons or granddaughters of people who were the beneficiaries of the aid to dependent children program.

The lack of motivation has set in; it has become inherited through the slums, and so on, and so forth. We have got to break it someplace.

Senator CLARK. Mr. Secretary, will you let us have your views in writing on recommendations from the chamber of commerce, as we asked Secretary Hodges to do?

Secretary WIRTZ. I will supplement my view, but it will be along the lines that I have indicated here, that the form in which the bill was passed by the House accommodates that position, I think, to the maximum extent advisable.

Senator CLARK. I only raised one of their comments. There were five others. I would like for you to take a look at them, also.

Secretary WIRTZ. I would be glad to do so.

Senator CLARK. Senator Randolph.

Senator RANDOLPH. Mr. Chairman, I would like the record to reflect that in my opinion, it is unnecessary to have additional hearings before having the subcommittee meet, and report to the Labor and Public Welfare Committee, and hopefully for that committee to send this measure, modified, to the Senate for action. I would hope that this could be done within the next 2 weeks.

Senator CLARK. I agree with Senator Randolph, but I would like to hold the record open until Thursday of this week, July 9, in the hope

that the two Secretaries will be able to furnish the additional information we asked them for.

Then, I would want to call an executive session of the subcommittee at the earliest possible moment.

Secretary WIRTZ. You would like the additional information by July 9?

Senator CLARK. Yes, sir; Thursday of this week.

Secretary WIRTZ. It will be here.

Senator CLARK. Thank you very much, Mr. Secretary. We appreciate as always your very helpful testimony.

Secretary WIRTZ. Thank you.

(The information requested above follows:)

DEPARTMENT OF LABOR,
OFFICE OF THE SECRETARY,
Washington, July 8, 1964.

Hon. JOSEPH S. CLARK,
Chairman, Subcommittee on Employment and Manpower,
Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: When I appeared before the subcommittee on July 6 in support of S. 2623, the subcommittee asked for our views on certain recommendations made by the chamber of commerce and Mr. Earle Benoit, of Columbia University, in letters to the subcommittee dated June 29 and June 4, respectively.

Upon reviewing these recommendations, we have concluded that the form in which the bill was reported by the House Education and Labor Committee took these various views into consideration and accommodated them to the extent considered advisable.

I would like to express again my appreciation of the opportunity extended to me on Monday to discuss this important bill with the subcommittee.

Yours sincerely,

W. WILLARD WIRTZ, *Secretary of Labor.*

DEPARTMENT OF LABOR,
OFFICE OF THE SECRETARY,
Washington, July 20, 1964.

Hon. JOSEPH S. CLARK,
Chairman, Subcommittee on Employment and Manpower,
Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: On July 8, I sent you my comments on certain questions raised by the chamber of commerce with respect to S. 2623.

I also was asked to comment on the level of the authorization appropriation inserted by the House Education and Labor Committee. Upon further review of this matter, it is my judgment that it is difficult to estimate the exact, amount needed, that a limitation should be placed in the bill, and that the House committee figure is certainly adequate. I note in this connection that the authorization is for the life of the Commission, about a year and a half.

Yours sincerely,

W. WILLARD WIRTZ, *Secretary of Labor.*

Senator CLARK. The subcommittee will stand in recess.

(Whereupon, at 11:30 a.m., the subcommittee was recessed, subject to the call of the Chair.)

APPENDIX

The Benefits and Problems Incident to Automation and Other Technological Advances

(Report from the President's Advisory Committee on Labor-Management Policy, January 11, 1962, Washington, D.C.)

President's Advisory Committee on Labor-Management Policy

Arthur J. Goldberg, Chairman, Secretary of Labor.
Luther H. Hodges, Vice Chairman, Secretary of Commerce.
Elliott V. Bell, chairman of the executive committee, McGraw-Hill Publishing Co., Inc.
Joseph L. Block, chairman, board of directors, Inland Steel Co.
Dr. Arthur F. Burns, president, National Bureau of Economic Research.
David L. Cole, attorney and arbitrator.
David Dubinsky, president, International Ladies' Garment Workers' Union.
Henry Ford II, chairman, board of directors, Ford Motor Co.
John M. Franklin, chairman, board of directors, United States Lines Co.
George M. Harrison, president, Brotherhood of Railway & Steamship Clerks, Freight Handlers, Express & Station Employees.
Joseph D. Keenan, secretary, International Brotherhood of Electrical Workers.
Thomas Kennedy, president, United Mine Workers of America.
Dr. Clark Kerr, president, University of California.
J. Spencer Love, chairman and president, Burlington Industries, Inc.
David J. McDonald, president, United Steelworkers of America.
Ralph E. McGill, publisher, the Atlanta Constitution.
George Meany, president, American Federation of Labor & Congress of Industrial Organizations.
Walter P. Reuther, president, International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.
Richard S. Reynolds, Jr., president, Reynolds Metals Co.
Dr. George W. Taylor, professor of labor relations, Wharton School of Finance, University of Pennsylvania.
Thomas J. Watson, Jr., president, International Business Machines Corp.
W. Willard Wirtz, Executive Director, Under Secretary of Labor.
Harry Weiss, Assistant Executive Director.

SUBCOMMITTEE ON AUTOMATION AND TECHNOLOGICAL ADVANCE

Clark Kerr, Chairman

David L. Cole	David J. McDonald
John M. Franklin	Ralph E. McGill
Joseph D. Keenan	Richard S. Reynolds, Jr.
Thomas Kennedy	Thomas J. Watson, Jr.

FOREWORD

This report to the President by his Advisory Committee on Labor-Management Policy deals with the benefits and problems incident to automation and other technological advances, one of the topics assigned to the Committee for consideration by Executive Order 10918. The report contains 11 recommendations for accomplishing, by a combination of private and governmental action, the necessary advancement of automation and technological change without detrimental sacrifice of human values.

This first report has the overall approval of all but two of the Committee's voting members. The two statements of separate views are included as part of the report. A footnote to the report records the view of five of the Committee members regarding the shorter work period issue.

The first report will be followed by others in the Committee's field of responsibility. Currently in preparation are recommendations concerning free and responsible collective bargaining and industrial peace, economic growth and unemployment, sound wage and price policies, and policies to insure that American products are competitive in world markets.

PRESIDENT'S ADVISORY COMMITTEE ON LABOR-MANAGEMENT POLICY,
Washington, D.C., January 11, 1962.

THE PRESIDENT,
The White House, Washington, D.C.

DEAR MR. PRESIDENT: We are pleased to submit the first formal report of your Advisory Committee on Labor-Management Policy. This report, dealing with "Benefits and Problems Incident to Automation and Other Technological Advances," was approved at a meeting of the full Committee today.

When you established this Committee last year, you expressed the hope that it would "help restore that sense of common purpose which has strengthened our Nation in times of emergency and generate a climate conducive to cooperation and resolution of differences." It is a source of deep satisfaction to us that this first report eloquently reflects that "sense of common purpose." There is unanimous agreement among the members on these fundamental points:

1. Automation and technological progress are essential to the general welfare, the economic strength, and the defense of the Nation.
2. This progress can and must be achieved without the sacrifice of human values.
3. Achievement of technological progress without sacrifice of human values requires a combination of private and governmental action, consonant with the principles of a free society.

This agreement reflects the Committee's conclusion that "automation and technological change have meant much to our country." The report as a whole has received the virtually unanimous endorsement of the Committee, while there are understandably some differences on implementation of these objectives. Statements of the separate views of two members of the Committee are appended to the report, and the positions of several members on one particular point are set out in two footnotes. Because the statement represents a consensus of the Committee members' views, their individual statements of position on various points covered would differ in some respects.

It is also a pleasure for us to report that the Committee has met regularly since it was appointed on February 16, 1961, and that the discussions at the Committee meetings have been most friendly and constructive. Our experience has demonstrated that your objective of bringing together top leaders of labor, management, and the public to arrive at a fuller understanding on vital policy issues can be achieved. We anticipate that recommendations concerning the other major topics assigned to the Committee—dealing with industrial peace, economic growth, wage-price policy, and world competition—will be forthcoming in the near future.

We commend to you the substantial public service rendered by the members of the Committee, who have dedicated themselves to the work of the Committee.

Respectfully,

ARTHUR J. GOLDBERG,
Chairman.
LUTHER H. HODGES,
Vice Chairman.

THE BENEFITS AND PROBLEMS INCIDENT TO AUTOMATION AND OTHER TECHNOLOGICAL ADVANCES

Three central propositions have emerged in the committee's consideration of the significance and impact of automation and other technological advances.

First, automation and technological progress are essential to the general welfare, the economic strength, and the defense of the Nation.

Second, this progress can and must be achieved without the sacrifice of human values and without inequitable cost in terms of individual interests.

Third, the achievement of maximum technological development with adequate safeguards against economic injury to individuals depends upon a combination of private and governmental action, consonant with the principles of the free society.

Automation and technological change have meant much to our country. Today the average worker in the United States works shorter hours, turns out more goods, receives higher wages, and has more energy harnessed and working

with him than a worker anywhere else in the world. Increasingly, machines are relieving men of heavy physical labor and of dangerous and repetitive work. Competition in the world markets has been possible against foreign countries whose standards of living are below our own, though this advantage is diminishing. Finally, in a world split by ideological differences, automation and technological change have a tremendous and crucial role to play in maintaining the strength of the free world.

For these reasons, we emphasize at the outset the imperative need for and desirability of automation and technological change. Indeed, increased productivity and fuller utilization of resources are urgently needed to improve our rate of economic growth. They are likewise needed to improve our competitive position in world markets. Failure to advance technologically and to otherwise increase the productivity of our economy would bring on much more serious unemployment and related social problems than any we now face.

It is equally true that the current rate of technological advance has created social problems and that an acceleration of this rate may intensify these problems.

While advancing technology has given rise to new industries and jobs, it has also resulted in employee displacement; and the fact that new work opportunities are eventually created is no comfort or help to the displaced individual who cannot, for one reason or another, secure comparable or any employment. While employment has expanded in some industries, the net effect of rising output per worker, of the growing labor force, and of other factors has been an increase in the volume of unemployment during the past few years—even as total employment has reached new heights.

The impact of technology on agricultural employment has been particularly great. Along with other factors, it has resulted in over 1,600,000 workers—20 percent of the total—leaving the farms since 1950. Yet farm output has increased 28 percent, making available to our people an abundance of food, while there was famine in some of the Communist countries. This increased output enabled this country to be of substantial assistance to needy people elsewhere in the world.

Our purpose, then, is to seek that course of action which will encourage essential progress in the form of automation and technological change, while meeting at the same time the social consequences such change creates.

We recognize that the subject of automation and technological change cannot be dealt with apart from two broader subjects: increased productivity in general, and unemployment.

We are preparing a separate report on economic growth, and only note here the basic importance of such growth to any consideration of the problems—and the opportunities—automation and technological advance present.

Regarding technological advance and unemployment, it is clear that unemployment has resulted from displacement due to automation and technological change. It is impossible, with presently available data, to isolate that portion of present unemployment resulting from these causes. Whether such displacement will be short run depends to a considerable extent on our ability to anticipate and plan for programs involving technological change and to make better use of various mechanisms for retraining and relocating workers who find themselves unneeded in their former occupations. We have necessarily given general consideration in this report to some aspects of the broader unemployment problem and to the prospects of more effective use of the work force.

A long stride toward solution of the unemployment problem will be made if we first recognize the nature of the problem. We regard the following factors as important in this connection:

1. The recent rate of economic growth in the United States has been insufficient to reduce unemployment to a tolerable level.

2. The exact extent of unemployment attributable to automation and technological change is unknown, since it is greatly complicated by other factors, such as:

(*a*) The economic recession of 1960–61.

(*b*) The unusually high entrance rate into the labor market, caused by the great postwar population increase. In the next 10 years it is expected that there will be a net gain in the labor force of 13½ million workers.

(*c*) Chronic unemployment in distressed areas.

(*d*) The effects of the rapid advances which have been made by foreign competitors.

(*e*) Changing consumption patterns.

(*f*) The changing nature of jobs which often leaves a gap between job requirements and qualifications of applicants. During the 1950's there was a 58-percent increase in the number of skilled technical and professional

workers. Unskilled workers, with only a limited education, found it more difficult to get, or hold, a job. In this connection, the Department of Labor projections indicate that unless steps are taken to reduce the dropout rate among high school students, some 7½ million of those new workers joining the labor force in the 1960's, or more than 30 percent, will not have completed high school, and over 2½ million of them will not even have completed grade school.

(*g*) Discrimination against workers on the basis of age, sex, race, and creed.

(*h*) Multiple jobholding by individuals.

(*i*) The continuing movement of workers away from the farms.

3. Public employment service facilities have been inadequate as well as seriously uneven in their effectiveness with respect to helping workers find new jobs, counseling them as to the kind of jobs which are liable to be available in the future, and advising them as to job prospects in other geographical areas.

4. The mobility of workers is reduced by factors running contrary to the demands of a dynamic society, and an economy in transition.

(*a*) The nontransferability of pension, seniority, and other accumulated rights may result in an employee's being dependent upon his attachment to a particular job as the sole means of protecting his equities.

(*b*) Desirable and essential mobility is affected by reluctance to leave home—because of personal ties, or because other members of the family may be working; by the cost of moving and possible losses on local property; and by the insecurity of jobs in a new locality.

5. Educational and informational facilities have been inadequate in that—

(*a*) The requirements for general education prior to vocational and professional training have not kept pace with the shift in job opportunities.

(*b*) The required types of vocational and technical training and retraining are often not available, e.g., for workers leaving the farm.

(*c*) There has been an inadequate liaison among school systems, industry, and government with respect to future job requirements, and in fact there is insufficient information about the nature of such jobs.

(*d*) There has been inadequate financial support for needy students.

(*e*) Counseling facilities have been generally inadequate.

6. Proper retraining facilities, and a system of financial support for workers while retraining, have been lacking.

These are some of the relevant circumstances of a society in which automation and technological advance are essential motive forces. The operation of these forces within the social context creates serious displacement problems—not as a necessary price of progress but as the stern consequence of failure to recognize and provide for these problems. We reject the too common assumption that continuing unemployment is an inherent cost of automation.

We believe, rather, that a combination of energetic and responsible private and public action will permit the advancement of automation and technological change without the sacrifice of human values, and that such combined efforts can cope satisfactorily with the total unemployment problem—including whatever part of it may arise from the displacements which result inevitably from the introduction of new devices and processes.

We do not attempt here an exhaustive exploration or enumeration of all the ways and means of achieving maximum technological progress with the minimum of individual disadvantage. Our suggestions can be only representative of a broader set of possibilities. We recognize, furthermore, that the totality of any combination of recommendations must be viewed in the light of such relevant factors as their costs to individual enterprises, their effect on the Federal budget, and their influence on general price levels.

We recommend that serious consideration be given the following measures:

1. Adoption by the Government and others of policies which will promote a high rate of economic growth and fuller utilization of resources. A much higher rate of growth is essential and is the best device for reducing unemployment to tolerable levels. We will include in our forthcoming report on economic growth suggestions in this area.

2. Acceptance by Government agencies of the responsibility for collecting, collating, and disseminating information with respect to present and future job opportunities and requirements in a rapidly changing society.

3. Cooperation between Government and private organizations in the field of education in improving and supporting educational facilities to the end that—

(*a*) New entrants to the labor force will be better qualified to meet the occupational demands of the future;

(*b*) The dropout rate at grade and high school levels will be reduced;

(*c*) Better vocational, technical, and guidance programs will be available;

(*d*) Rural and depressed areas, where surplus workers reside, will be better served;

(*e*) Financial support will be available for deserving and needy students; and

(*f*) There will be a general upgrading in the quality of our education.

4. Acceptance by management of responsibility for taking measures, to the maximum extent practicable, for lessening the impact of technological change, including:

(*a*) Adequate leadtime.

(*b*) Open reporting to the employees involved.

(*c*) Cooperation with representatives of the employees to meet the problems involved.

(*d*) Cooperation with public employment services.

(*e*) The timing of changes, to the extent possible, so that potential unemployment will be cushioned by expected expansion of operations and normal attrition in the work force (through separations resulting from retirement, quits, and so forth).

5. Support from both public and private organizations for retraining of workers who have been and will be displaced.

(*a*) Private employers and unions faced with automation or technological changes should make every reasonable effort to enable workers who are being displaced, and who need to be retrained, to qualify for new jobs available with the same employer, and to enjoy a means of support while so engaged.

(*b*) Where it s not possible for the employer to reabsorb displaced workers, appropriately safeguarded public support in the form of subsistence payments should be available to industrial and agricultural workers who qualify for and engage in retraining.

(*c*) Unemployment compensation laws should be liberalized to permit and to encourage retraining.

6. Support from both public and private sources, with due consideration to the circumstances of the enterprise involved, for the displaced worker who is seeking new employment.

(*a*) The duration, coverage, and amount of unemployment compensation, where inadequate, should be increased and made subject to realistic uniform minimum requirements under the Federal-State system.

(*b*) Employer supplementation of public unemployment compensation should be accomplished through severance pay, supplemental unemployment benefits, and similar measures.

(*c*) Attention should be given to provision for the special case of the worker who is displaced during the period when he is approaching retirement. This may appropriately include consideration of provision for early retirement, through private arrangements of social security measures; but alternative possibilities of more constructive temporary uses of such services warrant exploration.

7. Support from both private and public sources to the end that a worker's job equities and security may be protected without impairment of his mobility. This will warrant consideration, taking into account relevant cost factors, of such measures as:

(*a*) Financial aid in the transfer of employees to other plants in a multiplant system, and protection of existing rights for individuals so transfered.

(*b*) The use of public funds in order to give financial aid in the transfer of unemployed workers from one area to another where the result will be to provide continuing employment.

(*c*) The improvement of public and private protection of pension rights.

(*d*) The recognition by unions, individual employees, and employers of the necessity of adapting seniority and other rules in order to facilitate mobility of workers, while providing protection for the equities of employees.

The committee notes particularly the need for further study and exploration of this vital area.

8. Vast additional improvement of the public employment service so that it can effectively place, counsel, and relocate workers both locally and across State lines. We note with approval the start which has been made in this direction.

9. Vigorous and unremitting efforts by all segments of the population—including Government, employers, unions, and employees—to eliminate discrimination in employment because of race, creed, age, or sex.

10. There are pressing national needs to be met, and an abundance of manpower available to meet these needs. This matching of manpower and national needs, which is part of the vital context of the automation and technological advance problem, will obviously be affected by various broader governmental policies. Reserving fuller consideration of this area for our economic growth report, we nevertheless note here that:

(*a*) When technological changes or other factors develop particular pockets of unemployment, this becomes an additional reason for the undertaking, particularly at the State and local levels but with Federal assistance where this is necessary, of public development projects for which there is need, independent of the employment need itself.

(*b*) Every effort should be made to maintain on an up-to-date and ready-to-go basis a schedule of needed public development projects, particularly those which could be started most quickly and which would be of short or controllable duration, so that the initation of such projects can in the future be advanced, and the flow of projects already underway can be speeded up, if the manpower situation warrants this.

(*c*) If the operation of the economy, including the effect of automation and technological change, creates or leaves an intolerable manpower surplus, consideration should be given to monetary and fiscal measures—including the possibility of appropriate tax reductions—which would give promise of helping alleviate this situation.

(*d*) Governmental action along the lines suggested here, stimulated in part by the need to meet unemployment situations, would obviously have to take account of other considerations, including particularly the maintenance of national economic stability and security. We simply assert, however, the coordinate importance of stability and growth.

11. The need for goods and services must not be left unfilled, particularly in a time of international crisis. At the same time, high unemployment is intolerable. In the light of our current responsibilities to meet world conditions, and in view of our unmet needs at home, we consider the development of programs directed at the achievement of full employment as being more significant at the present time than the consideration of a general reduction in the hours of work. A reduction in the basic work period has, however, historically been one means of sharing the fruits of technological progress, and there may well develop in the future the necessity and the desirability of shortening the work period, either through collective bargaining or by law or by both methods. In connection with such a development, consideration would necessarily be given to the extent to which purchasing power could be maintained along with a reduced work period.[1] [2]

We affirm our conviction that the infinite promise of automation and technological advance can be realized without loss or cost of human values. America can enjoy the fruits of higher productivity without having to accept, as the inevitable result, serious social consequences growing out of the displacement of workers.

The recommendations made here suggest our view of a broader pattern of possible courses of action which would necessarily have to be adapted to particular circumstances, but which permit the constructive and responsible uses of technology and automation. We see no barriers—except misunderstanding, timidity, and false fear—to the accomplishment of this purpose by a coordination of private and public programs wholly consonant with the essential concepts of the free society.

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[1] Mr. Meany, Mr. Dubinsky, Mr. Harrison, Mr. Reuther, and Mr. Keenan are of the view that this paragraph should read as follows:

"The need for goods and services must not be left unfilled, particularly in a time of international crisis. At the same time, high unemployment is intolerable. In the light of our current responsibilities to meet world conditions, and in view of our unmet needs at home, we consider the development of programs directed at the achievement of maximum output and full employment as most significant at the present time. However, if unemployment is not reduced substantially in the near future we will have to resort to a general shortening of the work period through collective bargaining and by law. In connection with such a development, consideration would necessarily be given to the extent to which purchasing power could be maintained along with a reduced work period. A reduction in the basic work period has historically been one means of sharing fruits of technological progress."

[2] Mr. McDonald, Mr. Reuther, and Mr. Keenan comment as follows:

"We agree that, in the light of the considerations stated, the most desirable solution now to the problem of unemployment is the development of programs which will achieve full employment at 40 hours per week. Saying that this is the most desirable solution is not, however, the same thing as saying that we have in fact achieved that solution or that we will in fact achieve it in the near future. And only the fact of full employment—not a statement of its desirability—can properly serve as the premise for the statement that the necessity for shortening the work period will only develop 'in the future.' If we fail, as we have so far failed, to achieve the most desirable solution we will have to move more quickly than we are now moving in the direction of shortening the work period."

We assert the necessity of automation and technological development to the maintenance of American standards of living and to the fulfillment of this country's role of leadership in freedom's fight for survival. We assert equally the obligation and the capacity of Americans—as individuals and as a group—to use these new instruments and methods to enrich the lives of all of us.

We see no reason for alarm if out of a greater sense of common purpose we can achieve the good will and the determination to act together.

Comment by Arthur F. Burns

I find parts of this report highly constructive, particularly the recommendations designed (*a*) to achieve efficient and yet humane management of technological changes, (*b*) to improve the functioning of the labor market, and (*c*) to extend the coverage and otherwise strengthen the unemployment insurance system. Nevertheless, I am troubled by the report as a whole, and I consider it a dubious guide to economic policy.

The reasons for my dissent are as follows:

1. The report fails to identify or to analyze or to assess the quantitative importance of the different causes of unemployment. Nevertheless, it conveys the impression that technological advances are a major, if not the major, cause of recent unemployment. I know of no evidence to support this view, and I deplore anything that adds to the greatly exaggerated fears that many people have of what is loosely called automation.

2. The report suffers from a failure to link its proposed remedies to the causes of unemployment. Thus the report does not mention seasonal unemployment or ways of dealing with it. It does not mention the loss of exports by some industries or the policies needed for coping with this source of unemployment. It does not distinguish cyclical unemployment from other types or indicate how public policy for dealing with recessions should be improved. On the other hand, the report puts heavy emphasis on public works and seems to suggest that this kind of governmental spending is a good remedy for unemployment regardless of its cause. Unhappily, public works are poorly suited for dealing with mild recessions or with local pockets of chronic unemployment.

3. Most recommendations of the report are couched in such vague language that they may mean much or little, depending on how they are interpreted. But if experience is any guide, neither the vagueness of language nor the surrounding qualifications will prevent articulate groups of our society from claiming the authority of this committee for programs that could prove damaging to our economy. If all or most of the recommendations were implemented fairly promptly and on a liberal scale, both employer costs of production and governmental outlays would rise substantially. The report passes over lightly the question of how such increases would affect business profits or the Federal budget or the general price level. I find this question very troublesome at the present time. The deterioration of profit margins during the past decade is already a serious obstacle to achieving a high rate of economic growth. The protracted rise of the price level has already put severe pressure on our balance of international payments. This year's projected rise of Federal cash outlays already exceeds the increase of any peacetime year in our history and, the international situation being what it is, military expenditures may soon need to be still larger. In view of these facts, unless great caution is exercised in pursuing programs that raise costs of production or public outlays, we may find that economic growth is curbed, that confidence in the dollar is weakened, and that our international political position is undermined.

4. Apart from these dangers, the report fails to analyze how its recommendations would affect the volume of unemployment itself. The report seems to call not only for liberalizing the unemployment insurance system, but also for extending private supplements to unemployment insurance, for providing public subsistence payments to workers who undergo retraining, for lowering the age at which displaced workers can qualify for social security, and for using public funds to aid unemployed workers in moving to areas where jobs can be found. I deem it a duty to point out that if all these measures were adopted in quick order and on a substantial scale, some individuals who now are outside the labor force will see an advantage in entering it, while there will be others who, having quit or lost their jobs, will be tempted to take more time in settling on new ones. In other words, unless great care and caution are exercised in implementing the Committee's recommendations, the end result may well be the social misfortune of permanently higher unemployment.

5. In large part, the shortcomings of the report are traceable to the pessimistic assumption on which it seems to proceed—namely, that there is a serious possibility that our Nation's economic progress will prove insufficient to provide jobs for all those who are able and eager to work. I have greater faith in our Nation's future. A tremendous expansion of prosperity lies within our power. The degree to which we attain it will mainly depend, first, on how much work people care to do; second, on how productive they wish to be; third, on how earnestly we pursue public policies to stimulate new, creative, and more efficient economic activities by business enterprises. If the report had started from this broad but fundamental premise, it would have dealt more constructively with the economic and human problem of unemployment.

Comment by Henry Ford II

I share wholeheartedly the concern over unemployment expressed in this report, and I applaud this Committee's desire both to speed industrial progress and to spread its human benefits more widely.

Few things are as costly to our Nation, or as crushing to the human spirit, as lack of work for those who are willing and able to work.

Because I hold these views so strongly, I feel compelled to state my belief that this report does not really get to the heart of the matter.

Its major premise is the assumption that automation and technological advance are in and of themselves significant causes of unemployment—an assumption that neither history nor an analysis of current unemployment supports. Technological advance has been with us for many generations. But, popular beliefs to the contrary, technological advance has not been accelerating. Figures from the Bureau of Labor Statistics show, for recent years, an increase in productivity well below the average rate for the postwar period and not much different from the average rate since 1909.

Moreover, the factual evidence strongly indicates that, while automation displaces some individuals from the jobs they have held, its overall effect is to increase income and expand job opportunities. History teaches us that, by and large, workers displaced by technological advance have moved rapidly into other employment, ultimately to better paying jobs. This is why we have had rising personal incomes rather than mass unemployment as new technology has come into use and productivity has increased.

As Solomon Fabricant has recently pointed out (in his introduction to John W. Kendrick's "Productivity Trends in the United States"): "Better than average increases in output were usually accompanied by better than average increases in employment of workers and tangible capital, despite the more rapid rise in productivity. Correspondingly, less than average increases in productivity were usually accompanied by less than average increases (or even decreases) in output and in the use of labor and capital resources. * * * No one concerned with the rise and fall of industries, or—to single out a currently discussed problem—with the effects of 'automation' on employment, may ignore these basic facts."

When the economy is prosperous, displaced workers quickly find new employment. This is illustrated by the movement of workers off farms and into industrial employment when times are good, and the slowdown in this movement when times are bad.

The committee has recognized that the general problem of unemployment is the key problem, but its recommendations are concerned mainly with the important but secondary matters of retraining and mobility. A good employment service and unemployment compensation facilitate the transfer from one job to another, but these measures, even if accompanied by massive retraining, relief, and other social programs, will scarcely make a dent in unemployment when economic conditions are poor.

If, therefore, we would help persons displaced by technological advance, we must focus our attention not on relief or even training—though these, properly conceived and administered, will help—but on creating new jobs for people who seek them and can perform in them.

When wages rise faster than productivity in the economy, costs will rise and then either prices will go up or profits will come down—or both will happen. If profits come down, then incentive to save and to invest savings in new, job-creating plants, enterprises, and industries must suffer. Moreover, unless inflationary measures are taken to support the higher wage, cost, and price levels, demand will not be adequate to maintain production and employment. And, when the integrity of the dollar is at stake, inflationary measures cannot be taken without calamitous results.

We must find ways consistent with a free economy to keep wages and other costs from causing either unemployment or inflation.

I regret that the report does not make this focal problem the primary target of its comments and recommendations. For, when we have found and placed in operation those policies and practices that can keep costs from rising and forcing us into either unemployment or inflation, we will have done much more than could be accomplished by all other measures combined.

The recommendations in this report are concerned mainly with ways of preventing and relieving technological displacement. I personally endorse many of them, and the company with which I am associated has long followed practices similar to many of those recommended in the report.

Nevertheless, I have the following general reservations about the character of the recommendations:

First, they cannot solve the problem of mass unemployment because they are directed primarily at helping people to find jobs—not at the basic need for more jobs.

Second, the massive program of public and private actions called for may have unexpected consequences that the Committee has not been able to evaluate. Indeed, I believe that the knowledge and experience necessary to evaluate this sweeping program do not now exist, and that it is therefore inappropriate and unwise for this Committee to place its stamp of approval upon such a program. For example, greatly expanded Federal assistance could very well destroy incentives that stimulate private economic activity and generate individual initiative.

Third, the endorsement of comprehensive, economywide programs in very general terms diverts attention from and complicates the search for carefully selected measures to meet particular problems. For example, I believe that the main result of a large-scale, nationwide program to retrain the unemployed might be to impede the development of useful local programs carefully tailored to existing job opportunities and the needs and abilities of individuals.

In addition to these general reservations, I have misgivings about some of the specific recommendations.

With respect to unemployment compensation, I believe that duration, coverage, and amount of benefits must be increased where they are inadequate. In addition, safeguards to protect against abuses should be strengthened. I do not endorse Federal standards, but believe the States should continue with responsibility for fitting their particular systems to their own conditions and needs.

I agree that in the main the recommendations for improving our school systems are good. In many areas and localities, however, the most urgent need is not more money but greater public concern with what is taught in our schools.

Arbitrarily shortening the workweek in order to decrease unemployment would be a confession of defeat. Not only a poor remedy, it is also a harmful one, for it would retard the growth needed for the safety and welfare of our Nation at this point in its history. We can and should look forward to normal increases in our leisure time, but they must come as our growing economy can afford them and not as expedient solutions to unemployment problems.

In summary, I find some things in this report of which I approve, and much of which I disapprove. Its goal of making certain that high employment accompany technological improvement and increasing efficiency has my full support. However, I believe that the general direction of its recommendations is not well calculated to achieve this goal. I believe, too, that the report's basic assumption concerning the relationship between technological advance and unemployment is in error.

Therefore, I feel it necessary to say, with reluctance, that I cannot concur in the report.

Executive Order No. 10918—Establishing the President's Advisory Committee on Labor-Management Policy

By virtue of the authority vested in me as President of the United States, it is ordered as follows:

Section 1. There is hereby established the President's Advisory Committee on Labor-Management Policy (hereinafter referred to as the Committee). The Committee shall be composed of the Secretary of Labor, the Secretary of Commerce, and nineteen other members who shall be designated by the President from time to time. Of the nineteen designated members, five shall be from the public at large, seven shall be from labor, and seven shall be from management. The Secretary of Labor and the Secretary of Commerce shall each alternatively

serve as Chairman of the Committee for periods of one year, the Secretary of Labor to so serve during the first year following the date of this order.

Section 2. The Committee shall study, and shall advise with and make recommendations to the President with respect to, policies that may be followed by labor, management, or the public which will promote free and responsible collective bargaining, industrial peace, sound wage and price policies, higher standards of living, and increased productivity. The Committee shall include among the matters to be considered by it in connection with its studies and recommendations (1) policies designed to ensure that American products are competitive in world markets, and (2) the benefits and problems created by automation and other technological advances.

Section 3. All executive departments and agencies of the Federal Government are authorized and directed to cooperate with the Committee and to furnish it such information and assistance, not inconsistent with law, as it may require in the performance of its duties.

Section 4. Consonant with law, the Department of Labor and the Department of Commerce shall, as may be necessary for the effectuation of the purposes of this order, furnish assistance to the Committee in accordance with section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). Such assistance may include detailing employees to the Committee, one of whom may serve as executive officer of the Committee, to perform such functions, consistent with the purposes of this order, as the Committee may assign to them, and shall include the furnishing of necessary office space and facilities to the Committee by the Department of Labor.

JOHN F. KENNEDY.

THE WHITE HOUSE, *February 16, 1961.*

STATEMENT BY THE PRESIDENT UPON ISSUANCE OF EXECUTIVE ORDER ESTABLISHING THE PRESIDENT'S ADVISORY COMMITTEE ON LABOR-MANAGEMENT POLICY

(February 16, 1961)

I am today issuing an Executive order establishing the President's Advisory Committee on Labor-Management Policy. The Committee is composed of the Secretary of Labor, the Secretary of Commerce, and 19 other members from the public, labor, and management. The Secretary of Labor and the Secretary of Commerce will alternate as Chairman of the Committee for periods of 1 year, the Secretary of Labor serving during the first year.

The purpose of this Committee is to help our free institutions work better and to encourage sound economic growth and healthy industrial relations. The Committee will study, advise me, and make recommendations with respect to policies that may be followed by labor, management, government, or the public which will promote free and responsible collective bargaining, industrial peace, sound wage and price policies, higher standards of living, and increased productivity. The Committee has been directed to include among the matters to be considered by it: (1) policies designed to insure that American products are competitive in world markets, and (2) the benefits and problems created by automation and other technological advances.

I deem this a most important Committee. It will bring to the great problems in the fields of collective bargaining, industrial relations, wage and price policies, and productivity the experience and wisdom of labor, management, and public experts in these fields.

It is my hope that the Committee may help restore that sense of common purpose which has strengthened our Nation in times of emergency and generate a climate conducive to cooperation and resolution of differences.

It is my hope that the advice of this Committee will assist the Government, labor, management, and the general public to achieve greater understanding of the problems which beset us in these troubled times and to find solutions consistent with our democratic traditions, our free enterprise economy, and our determination that this country shall move forward to a better life for all its people.

* * * It is gratifying that I have been able to obtain the participation of such outstanding persons in the Committee's work. I greatly appreciate the willingness of these public-spirited citizens to serve their country in this way. The fact that such highly qualified persons have agreed to be members of this important Committee augurs well for its success.

AMERICAN FEDERATION OF LABOR AND
CONGRESS OF INDUSTRIAL ORGANIZATIONS,
Washington, D.C., July 7, 1964.

Hon. JOSEPH S. CLARK,
Chairman, Subcommittee on Employment and Manpower, Committee on Labor and Public Welfare, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: In connection with hearings by your subcommittee on proposals to establish a Commission on Automation, on behalf of the AFL–CIO I wish to make the following comments to supplement testimony we submitted on December 5, 1963.

In general we support legislation along the lines of S. 2623, a bill sponsored by Senator Hart to establish a National Commission on Automation and Technological Progress. This legislation is in line with the resolution adopted unanimously at the 1963 AFL–CIO constitutional convention and it is in line with a statement issued February 21, 1964 by the AFL–CIO Executive Council.

However, we believe S. 2623 should include a specific authorization of $2 million instead of the present general nonspecified authorization for the Automation Commission. The Commission cannot operate effectively unless it has adequate funds. Therefore, we ask that a specific authorization of at least $2 million be included in the legislation. Furthermore, we believe that your subcommittee should retain adequate subpena authority in the legislation establishing the Commission on Automation.

Mr. Chairman, I respectfully request that this letter and the attached AFL–CIO Executive Council statement be included in the record of hearings by your subcommittee on legislation to establish a Commission on Automation.

Sincerely,

ANDREW J. BIEMILLER,
Director, Department of Legislation.

STATEMENT BY THE AFL–CIO EXECUTIVE COUNCIL ON AUTOMATION COMMISSION

The time is long overdue for a full-scale national investigation of the social and economic impact of automation.

Now, before the toll taken by the new technology reaches more drastic proportions, a broadly representative Commission on Automation, composed of the ablest men in public and private life, should be established to do for America, what other national commissions have done in the past, in connection with other serious national problems.

A special Commission is necessary because the American people are confronted with a development which is profoundly changing the nature of our society. Automation is displacing thousands of jobs each week, while the labor force is growing at a stepped-up pace. It is destroying hard-earned skills. It is relocating plants and industries. It is disrupting entire communities. And, with unemployment at persistently high levels, it is affecting race relations, labor-management relations, and many other aspects of American life, as well.

For at least a decade, the Government has encouraged and subsidized the spread of automation. Billions of taxpayers' dollars have been spent to promote the technological revolution—through increased writeoffs for new plants and machines, the investment credit for new equipment and numerous research and development subsidies. But there has been little corresponding concern for the disruptive and dislocating effects of automation on workers and their communities.

An Automation Commission could begin to establish the needed balance between the fast-moving technological revolution and the adjustments to automation that American society must adopt, if it is to endure without vast disruption. It could help create a more general awareness of the human consequences of technological change and do much to make such change smoother, more orderly and humane.

Such a Commission could stimulate study on important aspects of the problem which have not yet been sufficiently explored. It could promote the establishment of new institutions, such as a technological clearinghouse, to gather information about impending technological changes far in advance of such changes, and a Federal Information and Guidance Service to assist unions and employers in the development of collective bargaining solutions to the problems of automation. It could recommend the kinds of over-all economic policies, both private and public, that would make the new technology consistent with the goals of the Employment Act of 1946. It could examine the training, worker relocation, investment, and

other programs adopted by nations abroad to meet similar problems and determine which of these could be usefully applied in the United States. In addition, it could coordinate and unify the efforts of various Government agencies now dealing with parts of the problem.

Given the freedom and willingness to "pioneer in the social, political, and economica spects of automation to the same extent that our science and industry have pioneered in its physical aspects," as the late President Kennedy suggested, a Commission on Automation, broadly representative of the major groups in our society, could help America realize the great promise of the new technology, while avoiding the kind of social havoc which followed in the wake of the first industrial revolution.

We therefore urge the prompt establishment by Congress of a Commission on Automation, composed of top leaders in industry, labor, and the executive and legislative branches of the Federal Government. The Commission should be empowered to take testimony under oath and subpena witnesses and should have an adequate appropriation for the employment of counsel and staff. The extraordinary and pressing nature of the need for jobs requires this action.

CHAMBER OF COMMERCE OF THE UNITED STATES,
Washington, D.C., June 29, 1964.

Hon. JOSEPH S. CLARK,
Chairman, Employment and Manpower Subcommittee, Labor and Public Welfare Committee, U.S. Senate, Washington, D.C.

DEAR SENATOR CLARK: The Chamber of Commerce of the United States of America supports establishment of a study commission, as contemplated by S. 2623 which would set up a National Commission on Automation and Technological Progress. We believe such a study commission could gather useful information.

To make S. 2623 more effective and to give the findings of the Commission the respect and recognition they deserve, we recommend the following improvements in the bill:

(1) Commission representation should be equal as between management and labor. Since the Commission will be composed of 14 members, 5 members should be selected from industry and 5 from labor organizations. Two other members of the Commission should be experts in the field of science and technology, preferably selected from the academic field. The remaining two members should be selected from the general public.

Commission members should also be appointed from among persons recommended by recognized organizations in the respective groups listed above. This is the procedure followed under the Welfare and Pension Plans Disclosure Act and in other instances where advisory groups are established and has proved to be equitable and satisfactory in practice.

(2) The Commission should be named the "National Commission on Technological and Economic Progress," deleting the word "automation," which, unfortunately, is a much-maligned word. Labor officials, for instance, have labeled it "the curse of the country." On the other hand, others have cited facts to support the conclusion that the benefits of technical change are such that public policy should foster it rather than shun it. Accordingly, it is our view that it would be preferable if the term "automation" were deleted and the body called, "The National Commission on Technological and Economic Progress."

(3) Because the legislation gives unnecessarily broad authority to the Commission to issue subpenas, section 10 should be modified to give the Commission power to "request" rather than "require" the attendance of witnesses and production of relevant documents.

(4) Section 6, which establishes a Federal interagency committee, should be deleted. If such a committee were created to "advise" and "maintain effective liaison" with the Commission the staff of the various agencies involved would be, in effect, ex officio members of the Commission and would tend to lessen its independence.

(5) Commission functions, as detailed in section 1(e), should be amended to give the Commission authority to recommend action by Federal, State, and local governments rather than the Federal Government alone. If Commission recommendations are restricted to action by the Federal Government, it implies that only the Federal Government is capable of dealing with the problem of technological progress. State and local governments also have a responsibility in this area.

(6) Section 14 should provide a limitation on the amount of funds authorized for work of the Commission.

We reiterate our support of the objectives of S. 2623. It is a recognition by Congress of the importance of technological change in our growing economy. With the amendments above, this study can be of value in meeting the challenges of a changing economy.

Sincerely yours,

THERON J. RICE,
Legislative General Manager.

OFFICE EMPLOYES INTERNATIONAL UNION,
Washington, D.C., July 1, 1964.

Senator CLARK,
U.S. Senate,
Washington, D.C.

DEAR SENATOR: Automation and its displacement of workers is of great concern to the Office Employes International Union. This organization does not oppose automation with its resulting increased productivity, but it does believe that reasonable safeguards should be instituted so as to minimize the effect upon all segments of society.

We in this union have had considerable experience with this technological change and have viewed its effects first hand. For this reason, we earnestly urge your favorable consideration of the following statement and suggested course of action adopted by the executive board of the Office Employes International Union:

"The executive board of the Office Employes International Union, AFL–CIO, meeting in New York City, June 8–12, 1964, urged Congress to immediately pass legislation recommended by President Johnson to set up an Automation Commission.

"The executive board believes that this legislation should not be delayed. It is essential that a tripartite Commission be established to conduct an intensive study concerning the effects of automation on the economy, particularly with respect to the dislocation of labor.

"The executive board also urges that the Commission be authorized to set up guideposts, regulating the introduction of automotive equipment which may further displace manpower.

"It is unanimously agreed that machines are eliminating jobs at a rapidly expanding rate. Little or no thought has been given by business, in general, to the social and economic implications particularly with respect to the loss of consumer purchasing power as unemployment increases.

"Our Government regulates the sale of securities, acts to prevent monopolies, licenses, patents and assumes numerous regulatory powers. Our States have full control over the pricing policies of utilities and regulates banks and insurance practices.

"Aimless automation can cause widespread unemployment, render large numbers of workers obsolete, and cripple consumer purchasing power.

"A National Automation Commission should be created and should be given adequate regulatory power immediately if we are to prevent national chaos."

Very truly yours,

J. HOWARD HICKS,
Secretary-Treasurer.

INTERNATIONAL ASSOCIATION OF MACHINISTS,
Washington, D.C., June 9, 1964.

MR. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower, Committee on Labor and Public Welfare, U.S, Senate, Washington, D.C.

DEAR MR. FRIEDMAN: This will acknowledge your letter of June 2, 1964, together with enclosures S. 2427 and S. 2623, proposals to establish a Commission on Automation and Technological Progress which were not introduced at the time of my appearance before your subcommittee on the general subject of automation and technological change.

From my analysis of the proposed bills, it is evident that the measure introduced by Senator Hart, namely, S. 2623, would, if enacted, provide for the broadest consideration of this very real problem which confronts both the labor movement and industry today. Therefore, for the consideration of the subcommittee,

please accept this letter as endorsement of Senator Hart's proposal, with the sincere desire that such legislation be reported to the Senate for final adoption.

Because of the fact that the problems of automation have been of deep concern ever since the close of World War II, we are in need of the speedy enactment of this authority to establish such a Commission without delay, particularly to meet the needs of manpower changes, unemployment and the effects of automation on our general economy.

With best wishes, I remain.

Sincerely yours,

A. J. HAYES,
International President.

UNITED AIRCRAFT,
East Hartford, Conn., June 9, 1964.

Mr. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower,
U.S. Senate, Washington, D.C.

DEAR MR. FRIEDMAN: Thank you for your letter of June 2 requesting supplemental comments on the modified proposals recently introduced by Senator Humphrey and Senator Hart.

As I indicated in my earlier testimony before the Senate Subcommittee on Employment and Manpower, United Aircraft is very interested in the committee's investigations into the applicability of new technology to the civilian economy and is equally concerned with the effect on our communities, manpower, and enterprise of any sudden conversion to a purely civilian economy. Last November we endorsed the bill introduced by Senator Hart, because we felt that the establishment of a Commission to consider this broad problem area thoroughly could serve a most useful purpose. We have no reason today to modify that opinion.

It does seem to us, however, that a considerable number of commissions, committees, and studies are being proposed or developed in various agencies of the Government to look into one or more phases of these broad and related problems. We believe that perhaps a consolidation of the various bills now pending into one which retains the more desirable features would serve to unify this effort and establish a single Commission which would have the necessary authority and stature to view these problems as a whole, to study their many interrelated facets, and thus to define more clearly desirable national goals. We do not feel we are in a position to comment in any meaningful way on the specifics of the modified proposals which you enclose.

Sincerely,

H. M. HORNER, *Chairman*

YALE UNIVERSITY,
New Haven, Conn., June 15, 1964.

Mr. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower,
Committee on Labor and Public Welfare,
U.S. Senate, Washington, D.C.

DEAR MR. FRIEDMAN: In response to your letter of June 2, I shall make only a few brief comments on the two bills, S. 2427 and S. 2623, both of which propose establishment of a Commission on Automation.

My preference is for the latter measure. As I see it, the heart of that bill lies in section 1(e) which charges it to make specific recommendations for legislative and administrative actions dealing with the effective channeling of technological developments and facilitating adjustment to them. Section 2 establishes the Commission to carry out that central function. This differentiates the proposed Commission from the several previous investigations of the impact of automation which have been conducted under Government auspices. In effect, Congress would be convoking a Commission of experts to review a knotty problem area and then to advise it as to how governmental responsibilities in that area can best be met. The report of the Commission is not simply "another" report but a coordinated program presented to Congress for possible action.

If I read the intent right, then I much prefer the Commission organization of S. 2623 over S. 2427. The Commission of 14 nongovernmental experts is a more suitable investigative body than a Commission of 32 inclusive of governmental officials and legislators. At the same time the advisory Interagency Committee

insures that the knowledge and experience of governmental agencies is fully utilized, without giving them the power to "protect" agency positions.

With the careful selection of the right personnel, with an appropriate emphasis of the grave responsibility being entrusted to them to review present and potential contributions of the Federal Government and how these can best be coordinated with the efforts of local government and private organizations, this Commission would have the possibility of taking us a good step forward in this important area.

Sincerely,

NEIL W. CHAMBERLAIN,
Professor of Economics.

NEW YORK STATE SCHOOL OF INDUSTRIAL AND LABOR RELATIONS,
CORNELL UNIVERSITY,
Ithaca, N.Y., June 11, 1964.

Mr. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower,
New Senate Office Building, Washington, D.C.

DEAR MR. FRIEDMAN: This is in response to your request to amplify my testimony before the Senate Committee on Labor and Public Welfare with regard to Senate Joint Resolution 105 and S. 2298 by commenting on bills S. 2623 and S. 2427. Before discussing the bills in particular, I would like to note that I perceive one of the major missions of the Presidential Commission on Automation to be that of bringing national attention to problems arising from automation. The committee should not necessarily be charged with prescribing legislation nor should it have to determine whether the private or public sector or some combination should assume the responsibility for solutions. The statements of such a committee should indicate the seriousness of certain problems, and while there will definitely be implications for legislation, their recommendations should not be so focused that they imply that Federal legislation is seen as the only means of ameliorating the problems. If the recommendations are too oriented toward legislation, it is possible that many segments of the public might ignore the problem because they disagree with the solutions.

Because I hold the above objectives for such a Commission, I feel that the group should be constituted primarily of persons outside of the Government. Such a group theoretically would not have vested interests in certain programs of action, and might have a somewhat broader perspective than a committee composed primarily of members of the Government who might be prone to examine the problem of automation from the point of view of required Federal legislation. The general outline of bill S. 2623 is in keeping with this orientation. This bill has the added merit of establishing a form of coordination among the various governmental agencies concerned with this problem. I would like to suggest that the chairman of the proposed Federal Interagency Committee be at least an ad hoc member of the Automation Commission so that he might better accomplish his task of maintaining effective liaison between departments and agencies and the Commission.

If the bills could be combined, I think the notion of advisory panels to a commission would be extremely important and useful and could still be provided for within the framework of bill 2623. This outside assistance seems to be provided within bill S. 2623, through section 11, which authorizes the Commission to negotiate and enter into contracts with private organizations.

If the concept of advisory panels, as indicated in section 3 of bill S. 2427, is maintained, I think it most important that panel members be drawn from Government. However, I would prefer to see more flexibility in terms of the type of competence required in order to be made a member of such a panel. In its present form, section 3 indicates that commissions may establish advisory panels which will consist of persons with exceptional competence and experience in the fields of science and technology, economics, political science, or operations analysis. A strict interpretation of this clause would preclude the inclusion of individuals in the fields of psychology, sociology, and many areas of education. I would prefer that no restrictions be placed on who should be members of the panel other than they should be individuals of competence and experience. If not, I would suggest that the lines 4 through 6 referring to section 3 read as follows: "The Commission may establish advisory panels which will consist of persons with exceptional competence and experience in the fields of behavioral or physical science and technology." This could incorporate economics and political science. I do not know whether it is necessary to have an equal balance, as implied, with

regard to representation from Government, private industry, and nonprofit educational or technical institutions, but I feel that it is only necessary to have these various sectors involved in each panel. If the Automation Commission is to be formed primarily of nongovernmental people, I would recommend that Members of the Senate and the House of Representatives be added to such panels. There are many Members from these two bodies who have considerable expertise in the related problem areas. Their continued participation in the panels would give them even more information to draw upon in framing legislation.

Bill 2427, seemingly, places a greater focus on the defense industry and the possibility of conversion than does bill 2623. While this area is not precluded in the broader directives of bill 2623, it is not specifically indicated. I think this is a very important problem which could become the focus of one advisory panel if the concept of advisory panels were included in the framework of bill 2623.

Finally, I note that both bills assume that a knowledge of current technological developments will enable a better prediction of manpower requirements. I assume that giving the Commission the power of subpena infers that certain organizations will be reticent to divulge their plans with regard to technology. I feel that even if the Commission were to receive full information in this area, it would still not be able to make more than gross assumptions about manpower requirements.

My own interpretation of advancing technology is that nearly all technological forms will require a viable, flexible educational system to handle the problems of recruitment or retraining. Because of this interest in education, I am opposed to the idea that the Commission be limited to considering problems that will occur within a span of 10 years. I feel quite sure that we can't accurately forecast the advance of technology even on a 10-year basis. However, the implications for education and mobility in other areas are such that even 10 years is too limiting a focus for looking at problems and solutions.

Sincerely,

LAWRENCE K. WILLIAMS,
Assistant Professor.

THE DIEBOLD GROUP, INC.,
New York, N.Y., June 22, 1964.

Mr. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower,
U.S. Senate, Washington, D.C.

DEAR MR. FRIEDMAN: I deeply appreciate the opportunity given me by your letter of June 2, 1964, to comment on S. 2427 and S. 2623 and expand on my testimony of September 20 and November 15, 1964.

To summarize my continuing view, I would like to make three points:

1. Public policy on automation must consider the total scope of social consequences and should encompass action by private as well as governmental (legislative and executive) entities.
2. Such action can only be helpful ultimately in ameliorating the problems and dislocations caused by technological change, if such change is encouraged at the same time as the social response to it is guided to maximize human benefits and minimize individual limits.
3. Governmental and private action must have followthrough: it cannot be on a one-shot basis.

My comments on the bills before your committee are made in the light of the above.

S. 2427

1. It provides for legislative and executive branch representation on the Commission. Possibly the legislative representation should be on an ex officio basis, as brought out in testimony. Possibly the executive branch representation should also be ex officio, as suggested in Senate Resolution 105.

2. The first sentence in section 1 states positively the need for technological progress—as does the beginning of Senate Resolution 105.

3. Section 1 (e), (f), and (g) supports the above statement with specific guidelines—as does section 1 (c), (d), and (e) of S. 2623. Perhaps some combination could be made in terms of assuring followthrough. I note that all bills call for a final report. Perhaps provision should be made for more continuing, broadly based guidance—not only labor-management oriented guidance as now provided by the President's Advisory Committee.

In this connection I should like to commend the provision for support of local, regional, and industrywide committees, as recommended in section 6(a)(3) of S. 1302, introduced by Senators Javits and Cooper and printed on pages 2902–2911 of the hearings. Perhaps some such provision could be made under section 3 of S. 2427, if the Commission could have a more long-term status.

I hope that these comments may prove helpful to the committee.

Sincerely,

JOHN DIEBOLD.

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK,
New York, N.Y., June 4, 1964.

Mr. EDWARD D. FRIEDMAN,
Subcommittee on Employment and Manpower,
U.S. Senate, Washington, D.C.

DEAR MR. FRIEDMAN: Thank you for your letter of June 2 requesting my comments on S. 2427 and S. 2623. Both these bills seem to me extremely worthwhile and likely to make a major contribution to the national welfare if passed. Of the two, I would prefer S. 2623, the Hart bill, because it provides for a smaller Commission and one that is chosen on an individual basis by the President rather than as representatives of various Government agencies and interest groups. It seems to me highly important that this subject be studied in a dispassionate way as free as possible from vested interests and prejudices. I also find the higher salary allowed to Commission members essential for obtaining persons of the right caliber and I would personally favor removing all specific salary limitations from the bill so as to permit the Commission to draw upon persons from business and the professions and to pay them roughly what they had been earning before.

I think the Hart bill is wise in establishing an Advisory Federal Interagency Committee consisting of the heads of interested Departments, or their designees, as such liaison and advice will be most important. I believe it would be similarly advantageous to establish a second advisory board comprising representatives of industry and labor organizations.

With respect to section 10 of the Hart bill, I am glad that the specific mention of subpena powers has been omitted, but the language still implies the possibility of compulsion of witnesses, the necessity of which I still fail to understand.

Section 11 authorizing contracts with private organizations seems to me highly advisable, as does section 12, attempting to assure the Commission the cooperation of various Government agencies.

I question whether it is a good idea to impose such short time limits on the final report in view of the magnitude of the studies likely to be required and the enduring nature of the problems being studied. In my view, a continuous, or at least intermittent, study of these problems and the establishment of a permanent policymaking machinery will ultimately be necessary. I suppose, however, all of this can await the action which will be taken on the basis of the Commission's report so that there is not too much harm in setting in advance what seems like an unrealistic terminal date for the Commission's activities.

Sincerely,

EMILE BENOIT.

SUPPLEMENTAL STATEMENT BY BEN B. SELIGMAN, DIRECTOR, DEPARTMENT OF EDUCATION AND RESEARCH, RETAIL CLERKS INTERNATIONAL ASSOCIATION AFL–CIO

We welcome this opportunity to comment further on the proposals to establish a Presidential Commission on Automation as embodied in S. 2427 and S. 2623. We have presented our views earlier on the same matter to this subcommittee which were reproduced in its hearings, part 9, pages 2343, 3325, and following pages. That statement was related in part to problems stemming from the reconversion of defense and space research plants to other uses. We urged at that time a striking parallel between the problems of reconversion and those stemming from the industrial and economic changes enforced by an ever accelerating technology. Moreover, it was our argument that technology seldom proceeds in smooth and even fashion and that shifts in the industrial mix have always occasioned marked social strain. We sought to bring to bear on this thesis pertinent historical as well as contemporary evidence to underscore the need for

foresight and preparation in dealing with the intense psychological and economic stresses that inevitably accompany technological change.

The pace of technical development is so rapid today that its economic application is unlikely to be restrained by the social cost it engenders. Automation has markedly increased the capacity of capital to produce, so much so that if we were to draw a chart of that capability it would exhibit a rapidly rising curve, one described as exponential in character. The curve of social cost would have to rise even more rapidly before it could begin to exert any restraining influence, but by that time the social turmoil engendered might well nigh become unbearable. Hence, we do need to think ahead, to study possible consequences and to design measures that would help mitigate whatever injurious effects might flow from technological change. Consequently, the proposed legislation to establish a Commission on Automation is a decided step in the right direction. It is an action that all of those concerned with the problem can have no hesitation in supporting.

No institution in our society bears a greater final responsibility for developing ameliorative measures than government. Private arrangements such as are embodied in collective bargaining agreements have been unequal to the task. Collective bargaining in meatpacking, printing, autos, steel, and on the docks has not been overly successful in dealing with automation. In fact, such schemes as profit sharing, cost savings sharing, severance pay, interplant transfers, or early retirement are of help only to the worker who is still on the inside. They do little for the worker who was displaced last year, or the year before or the year before that, nor for the young worker just out of school and looking for a job.

Further, it must be recognized that government, for reasons of national security, has been deeply involved in the development of the new technology. Our research and development bill, for which the Federal Government paid two-thirds of the $16 billion spent in 1962–63 and which goes mostly to aircraft, missiles, electronics, chemicals, and machinery, reflects that involvement. This is not unusual: it has always been expected that government would be concerned with such matters. As far back as the recorded memory of man can go, government has been involved in technology. One calls to mind the hydraulic societies of Asia in which large waterworks are maintained for irrigation and communication, the temples and pyramids of Egypt, the hanging gardens of Babylon, the bridges and aqueducts of Rome and, in our own age, the Manhattan project of World War II. In fact, it is in connection with matters of national security that government has the greatest need for the technologist and the scientist. The interrelationships of national security and technology has been emphasized by thermonuclear weapons, the cost of which can only be borne by government resources. And only the government can shoot satellites into the atmosphere and pay for the exploration of space. Sonic detecting instruments, radar, anti-aircraft control, proximity fuzes, and the computer itself, so central to automation, have been developed by the requirements of national security.

It is of course improbable that government can or will relax its interest in technology since the latter is required for security. We must guard our defense know-how much as the Byzantines held secret their mixture of sulfur, pitch, and naptha, a concoction that helped them keep the Arabs at bay for 400 years. Interchangeable parts, a basic principle of the present day assembly line was devised by the Frenchman LaBlanc in 1785 and the American Whitney in 1800 primarily for weaponery. Advances in navigation during the 17th century were fostered by governments to help navies in their tasks of defense, and the long search for an accurate method of measuring longitude at sea, to which men like Newton and Halley, lent their prodigious talents, represented an important service to government.

Nowhere is the relationship of the scientist to the needs of governments so clear as in the case of the computer. The idea for an automatic calculating machine goes back to the early 19th century when Charles Babbage, an English mathematician, proposed a device that would solve certain mathematical equations and print out the solutions. With the help of the British Government he began to build his machine in 1822 and by 1833 some £17,000 had been spent even though only a small model of the machine was ready. Several present-day ideas were anticipated by Babbage: automatic functioning, control units, and the selection of alternative collections of data. Unfortunately, the device was never completed, despite 40 years of work. Ironically, this early computer failed to influence future work, for the modern electronic computer began to be developed in the 1940's with no foreknowledge of what Babbage had done.

Yet government had a continuing need for just such computational devices. In 1915 Hannibal Ford constructed an analog computer to calculate the range

for naval guns. It was an important instrument during World War I. Improvements in such devices continued through the years, culminating in Vannevar Bush's mechanical differential analyzer built at MIT in 1931. Despite its cumbersome character, the Bush analyzer could solve a problem in about a half hour for which a mathematician might require a week. The machine was particularly useful in solving ballistic problems for the armed services. In 1942, it was replaced by an electrically driven analyzer (which was not yet electronic) and again was used for solving certain military problems.

Today such computers are all electronic in structure, employing voltages and circuitry instead of mechanical gadgets. About 80 percent of them are used for space and nuclear research. The second largest application is in the petrochemical industry where its use is widespread for controlling temperatures, pressures, and densities. In aerospace, the analog machine establishes preliminary systems requirements and airframe shapes. The Polaris missile has a built-in analog device which monitors its flight.

The early digital computers, such as Mark I, built by Howard Aiken, one of the pioneers in this field, were also used for solving problems related to the national security. One of the culminations of these developments is SAGE, a huge network of computers, perhaps the largest in the world, designed for continental air defense. SAGE took 7 years to build and the original programing, preparation of instructions and their translation into machine language, required 1,800 man-years to write. There is no question but that Government has a keen interest in the development of computers not only for purposes of defense but for data processing as well. By 1962 the Department of Defense had spent some $15 million on computer installations. Today the Federal Government is heavily involved in computer operations to the extent of a $23 million outlay in 1963 for data processing along. It now has over 1,200 automatic data processing systems and is the largest customer in a $3.5 billion a year industry. The growth in the number of computers in the Nation generally has been phenomenal; from 1 machine in 1945 to 20,000 in 1963 with another 5,000 to be added by 1965.

It seems clear then, that the Government has been deeply involved in creating a technology the distant implications of which are just beginning to dawn upon us. The impact makes itself felt in industry as well, where the search for labor-saving and even capital-saving techniques continues unabated. The wrench that this can give to the social milieu seems fairly obvious and it becomes increasingly painful as more and more humans are torn from that milieu to play out the last skeins of their lives in desperation and despair.

The way in which the new technology can affect us all may be illustrated by its applications to some of the more significant manufacturing industries in the country. While humans frequently exercised control and guided the machines and tools in the factory, methods in manufacturing have become increasingly automatic throughout the course of the 20th century. Indeed, semiautomatic machine tools provided only energy, with the skilled machinist still present to decide how deeply to cut into a metal workpiece or when to reset a tool. But when the computer and its associated feedback controls were hooked into traditional equipment, the workman was made redundant. For with these new devices information on performance could be fed back into the process to make all the necessary adjustments for possible errors—precisely the task that humans had always performed. During the decade of the 1950's the spread of computer control methods in industry began to develop in earnest. In 1951 only 7 general purpose digital machines were used in manufacturing: 10 years later there were about 7,500 such systems in operation. Some industries were able to move quickly into the new technology, for both the materials input and the product exhibited continuous process characteristics easily adaptable to the computer—oil refining, chemicals, power generation, and even steel. In the case of the latter, sheets must move through rollers at high rates of speed: variations of thickness must be detected quickly if the sheet is not to wrap itself around the roller. In chemicals, even more variables must be watched: raw materials mixtures must be carefully balanced, containers must not become overfull, impurities have to be removed, temperature and pressures are measured constantly, distillations drawn off.

Yet more and more the production of discrete products is being handled as a continuous process. This was demonstrated by the Western Electric Co. in 1961 with its computerized manufacture of carbon resistors, small devices that are used to control the passage of electric current. An air-conditioned dust-free plant produces 1,200 resistors an hour and the product is much more reliable now since the perspiration from human hands no longer contaminates the delicate carbon

covering. The resistor itself consists of a coated ceramic core with a metal cap at each end. The work itself is done on a 120-foot-long line with eight work stations, four inspection stations, and computer control system. Feedback mechanisms check the performance of the line at each station. All the work is done in a virtually continuous flow. Aside from some watching at the work stations the only human effort expended is in removing the package at the end of the line.

The advantages of these new methods seem obvious: great capacity, higher productivity, less time in production, increased time for machine operation, reduced inventory, reduced variability in the product, less floor space, easier maintenance, lower costs per unit of output, and in some cases even a smaller capital outlay. These are decided material gains and no doubt they enhance the profitability of the firm. Nevertheless, there are countervailing costs which do not enter into financial statements. And the pursuit of technological advantage tends to brush them aside. One must think of the humans who were once involved in industry.

Consider, for example, the striking development of numerical control in the machine tool industry. Here the computer itself guides the drill press or milling machine and the operation is taken completely out of the hands of the human operator. Complicated parts are carved quickly, accurately, and automatically. Rectangular blocks of metal can be machined into a complex missile valve or pump housing with only a punched tape as a guide. The numerically controlled machine tool operates in all three dimensions, automatically employs up to 60 separate cutting tools to do its job and replaces as many as 6 conventional machines and their operators. The method started in the early 1950's when efforts were made to carve helicopter blades out of a single slab of metal. By 1952 a conventional milling machine was developed to work with numerical controls supplied by a computer. By 1955 the technique was good enough to be displayed at trade shows. By 1957 airplane wings were being machined from single chunks of metal. By 1960 universal numerically controlled machine tools had been developed with five axes of motion able to perform a wide range of operations. By 1963 there were almost 4,000 numerical control machines in use, and annual sales of these devices had reached 25 percent of total machine tool volume, or about $200 million, six times what they had been in 1959.

With this technique the skilled craftsman is automated out of his job. But the engineers, too, who have developed the new machines are not immune. The more sophisticated examples of automation are turning on their masters, as it were, and taking over traditional engineering work much as they have taken over the grinding, milling, and boring. Computers design motors and decide on the best shapes for drying kilns. Original design problems involving variations of standard product lines can be solved by a computer in 30 minutes as compared with 6 days required by a man with a slide rule. The computer is fed the logic of a particular engineering design, so that when information from a new customer order for equipment is inserted, it uses its stored knowledge to generate design plans and to produce all the paperwork required to start the manufacturing process. Automatic drafting machines draw aircraft wings and lay out circuits in electronics. The function of an engineer's brains and the work of his hands can be given over to an electronic device.

Thus, discrete production can be converted by today's technology into a continuous process. Where the latter is inherent in the production of goods, as in electric power industry, there is no question but that automation is an indispensable condition. Here the computer is employed for data logging, scanning, warning systems, and for measuring performance. Automatic data logging makes it possible to operate the most complicated substation without anyone in attendance and with no loss of reliability or safety. It is estimated that automatic dispatch systems control 80 percent of the electric power capacity of the country. In cement manufacture, the computer solves raw material blending problems. At the United States Steel Atlas Cement Division, 14 old kilns were replaced with a single giant, 620 feet long which is fully computer controlled, the most automated of all cement operations in the country. In the petrochemical industry computers control cracking furnaces, blend gasolines, and do all the data logging, that is the recording of what takes place, an essential operation in any chemical plant.

Whatever industry one wishes to survey, it is possible to discover the beginning of automated development. This is the situation at present in papermaking, bakeries, steel fabrication, automobiles, shipping, railroads, and many others as well. While it is true that these methods have enhanced the capacity to produce and the rate of productivity there is little question but that they have had a

serious impact on jobs. Those who dispute this statement must quarrel with the estimate made by the Bureau of Labor Statistics, which pointed to a loss of 1 million jobs in manufacturing industries alone between 1953 and 1959 as a result of advancing technology, with prospects for the future looking even gloomier. True, employment between 1957 and 1963 increased 4.3 million in the "nonfarm sector" as indicated in the 1964 Manpower Report, but one must examine the sources of that growth. The fact is that direct employment by Federal, State, and local governments accounted for 46 percent of the increased jobs in those years: Government procurement programs accounted for 19 percent; nonprofit institutions for 16 percent; part-time jobs generated by private demand for 14 percent; and full-time jobs created by industry's own efforts for only 5 percent. Hence, it may be fairly concluded that private industry in recent years has not successfully met the challenge of automation, at least insofar as new jobs can be provided for an ever-growing labor force.

There is little consolation for the factory worker in the expansion of Government employment since the likelihood is that he does not possess the necessary transferable skills. In any event, further growth in the number of Federal jobs appears to be a doubtful prospect. To make matters worse, employment may drop because of technology in at least 18 major industries which have up to now enjoyed high volume, according to a joint report of the Department of Labor and Department of Commerce. In 14 other industries, moreover—trade, banking, insurance, transport, electronics, and synthetics—only increased demand can, in the opinion of the aforementioned report, overcome the effect of spreading laborsaving devices.

It is sometimes said that precedent for Government action to meet the problems stemming from changes taking place in the economy was provided by the Full Employment Act of 1946. But this statute fails to define what "full employment" goals ought to be in an economy undergoing constant change. The fundamental economic relationships involved are not very complicated: as productivity increases there must be a concomitant increase in output or jobs are bound to disappear. Technology, in part a child of government, has stimulated productivity, but production has not been increasing fast enough to provide all the jobs we need for an ever-growing population. From 1909 to 1947, the average annual increase in productivity was 2 percent; from 1947 to 1960 it was about 3 percent; and from 1960 to 1963 it rose 3.6 percent each year. With this annual rise in productivity and with some 60 million people in the private labor force, 2.1 million new jobs would have to be created every year just to keep unemployment from going up—and another 1.5 million a year to take care of the young people just coming into the work force. Now, while output has indeed been on the increase, the pace of the increase has evidently been too sluggish to compensate for the enhanced productivity stemming from the new technology.

It is argued by some observers that the sole solution to the problem of displacement is a higher level of aggregate demand. The recent tax cut was intended to provide a fillip for such demand, but it remains to be seen whether a further increase in our gross national product will do much for those whose skills have become unnecessary and unwanted. The Council of Economic Advisers asserts that there is a "proven capacity for a free labor market to reconcile discrepancies between particular labor supplies and particular labor demand." To judge by the experience of unemployed miners and redundant packinghouse workers, such a statement appears to be more an article of faith than a scientific statement. In recent years, the GNP has expanded as much as 6 percent per annum in current dollars, and not many new jobs have come into being, especially for those who need them most—the displaced, the young, the unskilled.

It is evident that we need to know much more about automation and its effects if we are to develop appropriate measures to deal with it. At the present time, such information as is available is piecemeal, provided by a variety of agencies in Government. The proposed legislation would help codify this growing body of data, but more important would provide some guideposts for developing the necessary approaches required. We commend the framers of these bills for the statesmanlike manner in which the scope of the proposed Commission has been defined: we think it would be difficult to improve the statement of purposes set forth in section 1 of each of the bills. And we commend the subcommittee for its careful consideration of the proposal. We urge quick and immediate action: one of the great contributions this Congress could make to a viable solution of the complex problem of automation is the passage of the proposed legislation.

THE UNIVERSITY OF WISCONSIN
SCHOOL OF COMMERCE,
Madison, June 5, 1964.

Mr. EDWARD D. FRIEDMAN,
Counsel, Subcommittee on Employment and Manpower, Committee on Labor and Public Welfare, U.S. Senate, Washington, D.C.

DEAR MR. FRIEDMAN: Thank you for sending me the new Senate bills for the Presidential Commission on Automation. I am enclosing a copy of a talk which I gave recently and copies of new publications we are distributing which I believe are relevant to my position on this topic.

Again I would like to stress that it is my feeling that the attention of this Commission should be directed specifically at strengthening and speeding up activities in the social sciences in order for them to catch up with the physical sciences.

I would suggest that one of the areas for which funds should be made specifically available is studies and experiments in the application of cybernetic principles of organization to the social and economic structure of the business enterprise. I believe this is where the solution to the problems posed by automation are likely to be found.

Under separate cover I am sending you five copies of our recent publications for distribution to the committee. Thank you for notifying me and allowing me to present my views.

Very truly yours,

J. J. JEHRING, *Codirector.*

NEW TRENDS IN PRODUCTIVITY MOTIVATION

(By J. J. Jehring, codirector, Center for Productivity Motivation, School of Commerce, University of Wisconsin, Madison, Wis.)

In the coming decades the social sciences, in my estimation, will play the most important role in developing increased productivity in our society. In the past, the scientist, the engineer, and the technician were considered to have shouldered the primary responsibility for the great growth of production and productivity we have experienced. However, this is about to change.

Toward the end of his career, someone once asked Thomas Edison what he thought would be the greatest invention of the future. Mr. Edison replied that he believed it would be the formulation of a social system which would enable mankind to fully benefit from the new discoveries in science and technology.

Currently, there are a number of interesting experiments with social systems taking place which have as their purpose the development of new forms of socio-economic organizations which can lead to increased productivity. Even though, upon analysis, it would seem that these new approaches hold a tremendous potential for helping man to better utilize his expanding technological know-how and increase the productivity of society, these new ideas do not now appear in the social science textbooks, because they have been as yet largely undiscovered by the social science researchers.

What is productivity? There are many definitions. Some are quite involved and technical, but in its simplest form, it is a measurement of the input-output relationships in any productive process. Inputs are those components that are needed to produce goods or services; outputs are results achieved in terms of services or goods produced. In its primary sense productivity can be equated with efficiency. When we say our productivity is rising we mean our society is becoming more efficient. It is using a lesser input to achieve a greater output.

These questions may be raised: Why do we have to be so concerned about efficiency? Aren't we efficient enough? Don't we have an affluent society? Unfortunately, no society can progress successfully and ignore efficiency. It is an absolutely necessary component for man's freedom. Efficiency is a relentless drive not only because of the ever expanding wants of individual men but also because the world is faced with a population explosion. A constant increase in efficiency is imperative also because of the necessity to free an increasing number of people to engage in those jobs which are of growing importance in our more complex society. Educators especially fall into this group. The pyramiding number of new jobs in this area must be supported by the increased productivity or efficiency which has taken place in the so-called productive sector of our economy.

If one were to consider the small number of schools and teachers our country could afford to support in the 1860's and compare it with the larger number in

1900, and the still larger number we are able to support today, some indication of the results of increased productivity on education becomes apparent.

It was impossible to have a high ratio of schools and teachers to total population in the 1860's because too many people were needed to raise the farm products, build the cities and the factories, and in general expand the frontiers. Today the situation is completely different. Science and technology invented and perfected the machines which permitted the substitution of mechanical power for human power and animal power. The inventions of the late 19th and early 20th centuries released millions of men. Due to the increased productivity resulting from new technologies, fewer individuals in business were able to do the work of many thousands who were then free to accept other positions. This shift to other jobs of a large segment of the population was accomplished only through making many significant changes in our socioeconomic institutions in order that the benefits of the tremendous power increase could be put to a social use.

Changes which were introduced, in order that the benefits resulting from released productive time could be spread to the advantage of more and more people, were many and varied. For example, revisions were made in methods of taxation. New taxes and forms of taxation were added to the original property taxes. The income tax and the inheritance tax were followed by the social security tax and the sales tax.

Educational institutions also went through many changes. Compulsory education at the primary and the secondary levels was introduced. Consolidation of small schools and school transportation was added. There was a rapid growth in adult education, the public colleges and the State universities. Many more teachers and administrators were trained and employed and students were kept in school for a much longer time.

Governmental institutions were also changed. We enlarged the Government at all levels. New regulatory bodies were established and various security departments were established. Service facilities such as hospitals were rapidly expanded. Large corporations were started. Monetary institutions of all kinds were formed and consumer credit grew rapidly.

It is evident, therefore, that there has been a continuous and tremendous growth and change in our socioeconomic institutions during the past 50 years, made possible only through the extraordinary increases in productivity which we have been able to achieve during this period. Much of this has escaped the notice of the average individual, perhaps because it has been so gradual that it has appeared to be evolutionary rather than revolutionary.

Most of this increased productivity has taken place because of the more efficient application of power to the production process. Now, however, in the decades ahead we are faced with the possibility of and the need for an even greater change in our social institutions. The reason is that we have a new and even more far-reaching development as far as a potential productivity increase is concerned appearing on the scene in the guise of the mechanical application of mental processes to the production of goods and services. This is being referred to as the cybernetic revolution, and in actual practice takes the form of utilizing the computer and automated machinery.

With automation, again we are faced with the need for a major overhaul of our socioeconomic institutions. However, this time the changes are likely to be much more radical than those that resulted from the application of power to the production process.

What are some of the changes that are likely to occur as a result of this new development? This is the question the social studies teachers should be asking. If you are seeking answers, it is quite certain they are not likely to be found in the social science literature today any more than descriptions of our current educational or economic practices could have been found in the literature of 1900. Perhaps occasionally one might find a brief mention of some new approach but the systems of the future are not likely to be in the mainstream of the literature. However, it is possible to obtain insights from another source as to the possible directions future changes might take. The place to seek them is in a study of some of the developments which are beginning to be utilized in certain areas of the business community.

In the private sector of our economy some executives are now experimenting with certain solutions which seem to hold considerable merit in terms of solving some of the problems posed by the cybernetic revolution. A study of these might offer some indication as to the direction our social institutions are likely to take in the future. For example, there has been a growing use of systems of incentives in our business sector in the guise of profit-sharing and production-sharing and employee ownership programs. Attempts are being made in some quarters to

increase productivity by substituting systems of labor-management cooperation for conflict. At the same time, there has been a rapid development of the idea of the saved wage in the form of various kinds of so-called fringe benefits.

These developments of sharing, cooperation, and the saved wage can be crucial for out State of Wisconsin in terms of productivity motivation. We are in a competitive market where added efficiency pays off for the society that can obtain the advantage of increased methods of efficiency.

It is important to note that motivation is one of the most significant factors in the history of man. Any human system, to progress, must have incentive. As Mr. J. W. Gardner, of the Carnegie Foundation, has pointed out in his recent book, "Excellence":

"Whatever the reasons for lack of motivation, the consequences are apt to be devastating. Nothing—neither wealth nor technology, neither talent nor wisdom—will save a society in which motivation continues to deteriorate."

These systems of sharing, cooperation, and the saved wage combine the best current knowledge in the social sciences in regard to organizational efficiency. If properly applied, they can result in creating organizations that maximize all the factors of production. Such systems can be called multimotivational, for they are the ones under which all the factors of production can be motivated at the same time. Workers and managers both share in the results which they achieve through entering into a previous agreement as to how the share is to be divided. In addition, stockholders benefit through increased dividends due to savings and growth in the value of their investments in a successful enterprise. In a competitive market consumers also benefit through the possibilities of reduced prices, increased quality, or better service. Recently, not only management but labor also has been advocating the use of such systems. Walter Reuther made the following statements:

"Why couldn't there be a basic wage—a fixed cost just as tax is a fixed cost or as the price of a ton of steel is a fixed cost, with its price having nothing to do with whether General Motors needs a lot of steel or a little steel? And at the end of the year, the worker having received his basic wage, then gets his share of the profits just like the president. General Motors will probably show close to $3.5 billion in profits for 1963. Is the equity that a GM worker has in that amount of profit different from when GM made only $1 billion? The answer is, obviously, 'Yes.' I am not wedded to the idea of profit sharing or progress sharing. I only say that if the competing equities have to be determined in advance of the facts, we are only guessing and there ought to be a more rational way of operating" (Walter Reuther in a speech titled "First Things First" given at the Fund for the Republic).

As you can well imagine, under a sharing system each is going to try to do his best in order to reap the greatest benefits. This holds true not only for the employees, but also the managers and even the stockholders. In the literature there are some amazing results that have been achieved through the effective use of the systems described above.

For instance, a small gray iron foundry in Ohio, recognized by the people in the trade as an extremely efficient producer, made impressive gains after installation of one of these sharing programs. While many gray iron foundries were going out of business, this company increased its sales from $407,094 in 1945 (the last year before the sharing plan) to $2,156,124 in 1955. The foundry was selling profitably at a price 40 percent below the average market price for gray iron castings in 1945, and through economies effected under sharing was able to sell profitably at 48 percent below the market average by 1955. These economies and increased sales boosted net profits before taxes from an index of 100 in 1946 to 423.9 in 1955, and permitted the employees to share $1,757,204 during this period, over and above their regular wages which were comparable to community and industry levels during this time.

This unusual achievement which benefited the customers, the stockholders and the employees was an outgrowth, largely, of the increased incentive achieved in the gray iron foundry through the successful operation of a sharing program which resulted in a 101.5-percent increase in good castings produced, a 245.5-percent increase in the value of such castings with only a 72.6-percent increase in the man-hours used. Absenteeism and tardiness significantly decreased, while at the same time the overhead costs per unit were lowered. Scrap was reduced 18.1 percent compared to the presharing period, 1938–41, while bonus months for scrap reduction increased 120.3 percent.

This demonstrated how one company, through the use of various management techniques, was able to achieve superior results. It also shows how sharing

enabled the management to apply certain new principles of organization to further increase the labor productivity of an already efficient operation.

In some of these systems another important item is added; namely, "the saved wage." This is, indeed, an important development which could have far-reaching effects on our future society. This saved wage in a sharing system is usually built up out of profits and as such does not add to cost and is not inflationary. It is invested in the name of the worker in stocks and bonds and earns interest for him. In many businesses this grows up into a very sizable fund. The annual income from these funds for the worker in some cases is larger than his annual wage. People who have such funds could afford to abandon their production jobs at an early age and assume other jobs in society of a nonproductive nature at a lower income rate without sacrificing a high standard of living.

John Gardner writes: "Organizations need not be designed in such a way that they destroy human initiative. They are designed that way because we have not been willing to be as inventive about organizational matters as we have been about hardware" (John W. Gardner, "Self Renewal," p. 63).

In a sense teachers in Wisconsin are able to share in this saved wage approach through our retirement system, especially with its variable annuity provision. This ties each teacher directly into the benefits which result from our work in teaching those who will eventually be the architects of our future productive society. However, achieving the increased productivity is only half of the problem—the other half has to do with creating the social institutions necessary to spread the benefits of this increased productivity throughout society. In this regard Mr. Gardner says:

"We must discover how to design organizations and technological systems in such a way that individual talents are used to the maximum and human satisfaction and dignity preserved. We must learn to make technology serve man not only in the end product but in the doing" (John W. Gardner, "Self-Renewal" p. 64).

It will be in the problem areas such as the senior citizens, medical care, juvenile delinquency, urban renewal, and expanded education where the new jobs of the future will be developing. Society will have as its prime task seeking out new forms of socioeconomic institutions capable of channeling the benefits of increased productivity so that they can be brought to bear upon these problems.

There are two important tasks before those of us who are concerned with the social sciences. First, it is our responsibility to educate the citizens of the future in such a fashion that they will fully understand the nature of the problems they face, and secondly, we must enable them to construct the proper kinds of social organizations that will enable man to take advantage of the new revolutions which are underway and at the same time protect his freedom while the physical wants of larger and larger numbers are being taken care of.

Much study remains to be done in the social sciences. We are just beginning to experiment with the newer forms of social organizations. We haven't yet fully invented the kind of institutions that will be required to fill the needs of tomorrow's society. Some business leaders are experimenting with ideas that could eventually comprise at least in part some of these newer systems. Such concepts as sharing, cooperation and the saved wage, and multiple management are likely to be important component parts.

"The most hopeful thing today is that on some fronts we seem to be achieving patterns of organization that avoid the stultification, rigidity, and threats to freedom inherent in monolithic interpretations. If this is true, it may be the most important single factor in our future" (John W. Gardner, "Self Renewal" p. 63).

The social studies teachers have a key role to play, for they can educate the students to an awareness of these newer developments. To accomplish this, teaching should be done not only from the standard texts which have been focused largely on the past, but it is necessary to seek out new materials that focus on the future as well.

We at the Center for the Study of Productivity Motivation are developing this type of teaching material which is focused on the future, and we plan to make it available as soon as possible to the teachers in the state of Wisconsin to help their students invent the new socioeconomic organizations.

Men vs. Machines:

AUTOMATION IN A WISCONSIN COMMUNITY

by John Newhouse

Mr. Newhouse is a staff writer for the *Wisconsin State Journal*, Madison, Wisconsin, and is a member of its editorial board.

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Automation's Blessings Are Mixed

(Sunday, November 17, 1963)

For better or worse, automation has come to Madison.

It's to be found in industrial plants, banks, insurance companies, the telephone company, and the plant in which our newspaper is printed.

All over town, people are learning to cope with the changes the more sophisticated machines bring with them, as they do more of the jobs people once did with muscle and mind.

Automation isn't hitting Madison with the impact it may have in a far more industrialized city, where hundreds or thousands of bewildered men and women may find themselves out of jobs and seemingly with no place to turn.

But management in many a Madison business is worrying about how far to go on automation, and what its effects will be. And many a worker is eyeing his job in terms of the machine that one day may take his place.

Take the Gisholt Machine Co., for instance.

A pair of big machines stand on the production floor. They are called Milwaukee-matics. They cost a quarter of a million dollars each. They run 24 hours a day. At that price, they have to.

On the side of each machine is a drum. It holds 30 machine tools. Beside the machine is a cabinet with hundreds of transistors, miles of wires, and a tape that tells the machine what to do next.

The tape gives the orders. The drum rotates, to bring the next tool needed to the fore. An arm plucks the just used tool from the chuck of the machine and carries it back to the drum. At the same time, the new tool is carried to the chuck and readied for work.

As this is going on, a metal casting on a circular table called a palette turns to a commanded point and stops. The body of the machine slides horizontally to one side—just enough. It rises—just enough. The new tool advances and drills a hole—in just the right place and just deep enough to satisfy the tape.

And this goes on, operation after operation.

At the side of the machine sits a man who used to do many of these jobs on less sophisticated machines. Now his work is reduced to fastening

the casting on the palette, making sure the machine performs perfectly, and removing the casting when the work is done.

What does he think of automation?

"It's here," he says. "You can't stop it."

He works the same number of hours as he did on his former job. The rate of pay is the same. But he isn't using the skills that he once used.

The Gisholt company has no alternative but to go to the machines, they contend at Gisholt. The competition is becoming automated. The machines don't get tired. They don't make errors. They don't get in squabbles with their in-laws, and mope. They don't take coffee breaks. They work 24 hours a day.

And this can be reflected in lower costs which mean greater sales and protection of jobs.

"The machine tool company which will survive will be the company which makes the most intelligent use of automation," predicts Rodney Stebbins, assistant sales manager.

And this brings up the question as to just what is automation.

"Automation is a continuation of the industrial revolution, but with feedback," says John Wrage, public relations director for Gisholt.

Some define mechanization as the process by which a machine puts peas in a can, while automation is the process of putting the peas in the can AND making a decision as to which peas shouldn't go in the can and discarding them.

Others say that automation occurs when one machine does a job virtually by itself, and then hands it on to the next machine to do still more work by itself.

On the national level, there are several schools of thought. One holds that end result of automation will be a shift of people in jobs, the creation of many more jobs, and a better way of life.

The opposing school of thought holds that this is the industrial revolution, all right, but it's gettting out of control. It's erasing jobs much more rapidly than they can be, or will be, created. Unless the benefits are spread much more widely, through shorter work hours or some equivalent, humanity is in for tough sledding.

At Gisholt, no one s predicting just where it all will end.

Its Own Role

Ironically enough, the Gisholt firm owes a good part of its present pre-eminence in the machine tool world to automation, introduced long before the word was coined.

Back in the 1940s, Werner Senger, now a vice-president, came up with

a balancing machine. It evolved into a tool which would balance an entire engine, finding the amount of imbalance and its location, and then adding a bit of welded metal or removing a bit of metal through boring to put the engine in balance.

It was automation at its finest. It has helped the Gisholt company to grow here and give jobs to Madison people.

Widespread Effects

Its effects in the American economy have been widespread, and also impossible to measure. Turbines spin at faster speeds. Electric motors are smoother. Cars go faster. And all of this has undoubtedly created jobs elsewhere by balancing machines which humans, without the Gisholt balancers, couldn't balance.

Today, the Gisholt company is automating its newest lathes, in the never-ending battle of industry to put out the best product and make the most sales which, in turn, will protect the jobs of workers.

There are some men, such as those on the Milwaukee-matics, whose jobs have changed.

And there are new jobs.

Somebody has to punch the tape that tells the machines what to do. This is a new, skilled job.

Another new job is that of programming. Computers can produce all sorts of information a modern company needs, but somebody has to be smarter than the machines to tell them what to do.

If a client calls Stebbins to ask when he can expect delivery of a new $200,000 machine, Stebbins can call product control. Cards zip through a sorter. A computer analyzes them; and in minutes, he has a progress report on the machine.

Then, he can advise the client, who can fit a realistic delivery date into his calculations.

'New' Service Man

Another "new" job is that of the service man. No longer is he a man with dirty hands and a monkey wrench. He wears a business suit. He flies by jet, for his time is important. He gets a good income, based on his knowledge of electronics.

He looks over the plants where he services machines for places where other machines of his company will fit in. Salesmen follow up his tips. Executives worry about how to buy the machines, how much money they will make them, or what they will do to the relations between a plant and its people.

The worry over people is a considerable problem at Gisholt.

Shift in Jobs

"Ideally, automation should not result in unemployment," says Wrage. "If anything, it ought to increase employment. But this can be accomplished only at the cost of shifting people from one job to another. And the best shift, of course, is to a higher and a better job."

This means, he says, that some people should be training for the better job, to be ready for the shift when it comes.

And the problems will be with the person unwilling or unable to learn that new job.

Furthermore, he says, automation is changing hiring patterns. At one time, he said, the man sought was the man with the weak mind and strong back.

Different Pattern

But a different pattern looms today. The accent is on the man who can advance to the better job, if the machines demand that advance—not the man who won't or can't change.

"And the problem of the future may well be this army of unemployables which include the most tragic of all, the persons with good capabilities who drop out of school and find themselves with no place to go," Wrage says.

Over in one end of the production floor of the Gisholt plant, there are three lathes. One of them has a human operator, making the changes as they are needed, watching the work, intent on his job.

End Unknown

Two of the lathes are doing the same work, at the command of little black boxes mounted atop the machines. Their operator sits some 50 feet away.

No one knows exactly where it all will wind up.

But there is a lot of concern, both on the part of the worker and of the plant management.

II

Automation Can Develop Jobs, Too

(Tuesday, November 19, 1963)

VERONA—The Carnes Corp., in Verona, is growing like all get out.

Since 1957, when a new management took over, the number of square feet of manufacturing space has more than doubled.

The number of people on the pay roll has increased from 150 employed here in Verona to more than 500, with another 50 employed in a new plant in Canada.

And gross sales have increased from $1.8 million to $8.9 million.

There are any number of factors concerned in the rapid growth, ranging from good management and heads-up engineering to the luck of having a product in demand at just the right time.

But high among the factors is automation.

The Carnes Corp. is an instance of a corporation that had to go to automation and where, for a time, automation put people out of work. But, in less than three years, the automated machines created a climate where more and more men and women were able to find jobs at Carnes.

And now the number of jobs has more than trebled.

The Carnes Corp. has had an interesting history. It began in a garage out on Helena St., in Madison, back in 1943. It was started by Wilbur Carnes, now Madison's 16th ward alderman. He was a good engineer, an ingenious operator, and he knew a good thing when he had it.

The "good thing" was a line of air distribution equipment—diffusers, grills, and registers which distributed air from central heating or air conditioning units evenly into rooms, plus a line of power ventilator equipment for exhausting air from buildings.

In Market at Good Time

He came on the market at a particularly good time. There was a vacuum in such equipment, and he was able to use the national distribution system of the air conditioner people for rapid growth all over the country.

The garage grew too small. Additions were made. In 1950, the plant

moved to Verona. The original small buildings were added to, time after time.

Then the inevitable happened.

Other firms noted what Carnes was doing. They entered into competition. As the competition strengthened, more and more attention had to be paid to cost in the now more competitive market.

In 1950 there were only five manufacturers in the country, a figure which was to grow to more than 50 today, with Carnes and two others in a tight tie for second place in the field.

Big Loss Factor

In 1957, Carnes sold out his interest in the company for more than $1 million, to the Dings Magnetic Separator Co. of Milwaukee. And, in view of the new highly competitive situation, the new management started some intensive cost accounting to find the weak and strong areas.

They found them in a hurry.

"We found that one of our main lines was operating at a 15 per cent loss," R. W. Krogstad, general manager, said.

There was some real soul searching in the next meeting of the board of directors. The loss couldn't be allowed to continue, for the line was a major part of the plant's output.

Nor could the line be dropped, for the same reason.

"We decided that the only answer lay in automation," Krogstad said.

Machine Pays for Itself

So the firm put in a conveyor system, costing $10,000. It paid for itself in three months. The management looked around for automated machines which could be bought and which would fit their operation.

And, when they couldn't find a machine, they designed one and had it made.

The new machines began to put people out of work. For two and a half years, employment was lower than when the Milwaukee group took over. But then, as the groundwork laid in those years began to take effect, it began to rise dramatically.

Automation was a part of the answer. Another big part was the realization of the management that it had to put out not only a product that would compete price-wise with their competitors, but also a better product.

More Engineers Hired

As a result, the engineering department was beefed up. From three engineers in 1957, the number has risen to 28. They work on such things

as simplifying the design of their product so that it can be automated more, and produced at a lower price.

They work on new machines which will increase automation.

And they work on a product which will work better and look better. As an example, the firm has put a considerable amount of money into one of the quiestest test rooms to be found in any manufacturing plant. Walk through the big door of a test room bigger than a haymow in the middle of the throbbing plant, pulsating with all of the noises of production, and you can all but hear your heartbeat.

When tests are being run, a register or grill will be fitted into one wall of the room, and air brought into the room through it. Then sensitive instruments determine how much noise is caused by this particular design as compared with another.

And the tests are done under formulae devised at Carnes which are rapidly being accepted as standards for the industry.

Some Jobs Can't Be Automated

In other rooms, grills and registers are testing to make sure that they give the best distribution of air to all parts of a room.

In the plant, there are some jobs that cannot be automated. Big discs of aluminum for diffusers or ventilators are still spun into forms where the desired designs are so varied or used so infrequently that to automate their manufacture would not be feasible.

As the flat discs spin on a shaft, skilled men with dual levers force the aluminum or steel over chucks to form the part into grills and registers in an old German process.

For centuries, spinning has been the best way to do this work, and the high degree of skill required cannot be automated.

But, in other parts of the plant, machines take seconds or minutes in doing jobs that would take human operators far more time.

"We're going in more for engineers than bolt twisters," Krogstad said. "Many of the tasks which we have eliminated for people are the more tiresome jobs."

The Final Score

But this final score remains:

The Carnes Corp. has used automation to create more jobs, and better jobs, in an industry which nationwide is creating still more jobs because of automation.

Another 400 more people are working at the Carnes Corp., due to automation.

And what would have happened if the firm had not gone to automation?

Krogstad shrugs his shoulders. It's anyone's guess.

But there is the possibility that the 150 jobs existing at that time would have gone down the drain of a failing firm, and that 550 people would be in other jobs, or looking for other jobs.

III

Automation in Bank Costs No Jobs

(Thursday, November 21, 1963)

When the Bank of Madison decided to go to automation, first in check sorting, they put the big new sorter in the lobby of the bank.

A comment that was made, from time to time, was:

"Huh, I suppose you're just trying to put people out of jobs!"

At the bank, they early learned to counter with:

"How'd you like to stand at a rack all day long, sorting checks into little boxes?"

And it was this reluctance of people to do this work which was a considerable reason for the bank to go to automation.

Can't Find People

"You just can't find competent people to do this work any more," Frank Saeman, controller of the data processing department, says.

"Eighty-five per cent of the girls go on to college, perhaps. They won't take such a job. The remaining 15 per cent go into various service jobs and, frankly, it's difficult to find the necessary abilities within this group."

The decision was based on more than the difficulty of finding people to do tedious work. The bank set up a four-point criteria, based on its effect on the customer, the community, the employe, and the stockholder, according to Paul Schroeder, president of the bank.

And, having determined that the change would be beneficial, the bank decided to spread the change over five years, to cushion its impact.

No Jobs Lost

So far, Schroeder said, no one has lost a job at the bank because of automation. And he doesn't feel anyone ever will.

You don't save any money in a bank through automation, Saeman says, but you do get the job done. And it's a job that is growing bigger every year.

Since the check sorter has gone in, the bank has also automated the bookkeeping department.

"We had four sorters and five bookkeepers," Saeman says, "Now we have six persons, plus the machines, doing the same work within this department."

But no persons have been let go because of the elimination of the three jobs. The three have been absorbed in less tedious or better paying jobs, for the growth of the bank has been considerable in recent years.

Deposit Growth Cited

Since the bank merged with the Union Trust Co. in 1956, the deposits have grown from some $16 million to between $36 and $40 million.

"And Madison is one of the check-writingest cities in the nation," Saeman noted. "We average about 14 checks per account per month, as against a national average of six to eight."

The automated check sorting and bookkeeping departments, now known as data processing, are on the third floor of the bank.

And it's a decided departure from the way things used to be.

At one time, workers on adding machines "proved" big batches of checks on adding machines, to check the totals; others sorted the checks and put them in alphabetical order, and bookkeepers flipped their ledger sheets into machines all day long, and made the proper entries.

'Iron Idiots'

Today, the incoming checks go to one of two women who "prove" the batches of checks by entering them in a new machine which not only adds up the totals but puts the account of the check down at the bottom in symbols which the sorter can read.

"The 'Iron Idiots,' " says Saeman of the sorters, "can not read your handwriting.

"That's why we have to use a special magnetic ink which prints the amount on the check, in the same manner that the account number and the bank number is already printed on your personal checks."

Next step is the sorter. Checks go through this machine at the rate of 750 a minute, traveling so fast to various compartments that they're just a blur.

There are nine compartments. Three are for the banks personal checks and three for the bank's business checks, in three alphabetical groupings. Another is for the Monona Grove State bank and another for the Hilldale State bank, whose sorting and bookkeeping is done here.

(The Bank of Madison was the first in Wisconsin, outside of Milwaukee, to automate check sorting. Other Madison banks are preparing checks

for automation, and generally will send them to Milwaukee each night for processing and return to Madison the next day.)

A final pocket is for rejects—the check that was badly printed, the check that went through folded and hence unreadable, and the like. These are checked by a human operator, and their numbers are small.

As the checks whir through, the sorter does a fantastically rapid job of checking each account number, to make sure that it's a valid number. Occasionally, the printer of the check makes a mistake. Or, if the account number is not on the check, it may have been put on by a special machine and the operater has made a mistake. You can check the number on your own check by multiplying the first numeral by eight, the second by seven, the third by six, and so forth, then adding the totals all together and dividing by 11.

If the number is valid, there will be no remainder, for 11 will go into the total an even number of times. If it won't, the number is not valid.

And the sorter does this with checks flitting past at the rate of 12½ per second, and does it in the 12 inches or so of travel between the reading head and the reject compartment!

Puts Them in Order

While the sorter is checking the account numbers and putting the checks in the proper compartments, it is also sending a continuous stream of information to the computer. It tells the computer, among other things, the amount of money to be withdrawn from each account number.

The checks, mind you, are not in alphabetical order. So the computer performs its feats of electronic legerdemain, and spews forth a tape on a high speed printer—so high speed that it prints 160 digits a second.

And now they come out in alphabetical order!

The tape then goes to one of three automatic bookkeeping machines. The ledger sheets, also in alphabetical order, are pushed up to the machines. The machine pulls a ledger sheet within it. If the tape finds it has a deposit to make, or a check to subtract, the machine gets the order, and the entry is made.

And the operator sits and watches, in contrast to the day when the bookkeepers bent over their jobs the day long as their fingers flew up and down the keys and their hands banged the total bars.

The customer has an interest in what's going on in this room, and it can be expressed in service charges.

"Our service charge is 10 cents a check," Saeman says. "The actual cost of handling a check, before automation, in the nation was 12 cents. We're able to continue the 10-cent charge, now that we're automated.

"But there are non-automated banks, particularly on the East coast, where they're charging 15 and 20 cents a check. And, without automation in this bank, it seems certain that we'd have to increase the service charge."

Can Do Other Things

The machines do other things. They can be made to tell the operators, via numbers on tapes, which account numbers have the last three digits alike, or within 30 of being alike. They can be told to disregard the fact that there is no bank number on a check, that it is vouched for by the human operator.

But telling the machine is a complicated operation. The directions may run into a formula expressed on a piece of tape several feet long, four inches wide, and completely filled with numbers—all of which have to be right.

"They're really stupid monsters," Saeman says, "but they'll do what you tell them to do. For instance, one bank got a little tired of reading a numeral '4' to indicate someone had transposed a figure, such as writing 23 for 32.

"So they commanded the machine to give them a written message instead, and told it what to say.

"And now the machine writes, **'Better luck next time, stupid!'** "

IV

Machines Replace, Improve 'Hello Girls'

(Sunday, November 24, 1963)

On Oct. 1, 1949, the last of the "hello girls" to handle local calls trooped out of the Madison office of the Wisconsin Telephone Co.

Behind them they left silent switchboards. No buzzing signals. No flashing lights. No people in the operators chairs where people had sat since 1884 when the telephone had come to Madison.

End of Era

It was the end of an era. The machines had won. Dials had beaten the "hello girls."

"You got a funny feeling," says Marion Batty, who was there. "That empty room. The quiet. The feeling that a machine could do your work. That you didn't count for much. It was a little scary."

How does she feel about it today, 14 years later?

"Oh, it's far better today," Miss Batty, now a chief operator, says primly.

"I wouldn't dream of going back. We're doing a better job. It's more interesting. There are more people . . ."

Huh? More people?

Sure, says Jack Mayer, Madison manager. The company is employing 24 per cent more people.

And that's the telephone company. It's a place of rapid change. There are lost jobs in one place. But new jobs have popped up in another. Machines have taken jobs here, and machines have created jobs there.

Here's a job that brought in somebody from another community, and there's a job that was created in another community to be considered in the bewildering picture of what—job-wise—has been happening.

Devices Clicking

And you wind up with the feeling that the biggest computer couldn't trace all of the ramifications and significance of what's been happening in the telephone system.

But come along and try, anyway.

Mayer stops at a door, and unlocks it. Inside, in the gloom, is a room filled with electronic devices on racks, clicking away like an army of robots, following the directions of dialing fingers all over Madison.

The little electronic gadgets, clicking their lives away and oblivious of watching humans, are making the local calls the "hello girls" used to make.

'Lucky They Are'

"They make 400,000 calls a day," says Mayer. "In the 'good old days,' it took a good operator to make 1,000 calls a day. These gadgets are doing the work of 400 good operators."

And it's lucky they are, says Mayer.

"It would be impossible to find 400 good operators to do this job," says Mayer. "We'd have to take just about every girl who graduates from high school and does not go on to college.

And frankly, not every one would meet our standards. They are getting higher each year, to meet the quality of service the public expects."

More than that, the increased volume of business is dependent upon automation, and automation in turn is making the job bigger each day.

101,904 Phones

Back in 1945, Madison had 34,490 telephones. Today the number has risen to 101,904, three times as many.

Back in 1945, there were 176,000 calls handled per day by the human operators. Today it's 413,000, a 134 per cent increase.

And, during that time the city has grown 55 per cent, so that the increase in number of phones and calls is more rapid than that of population.

But the employment growth of the company, though substantial, is not as rapid as that of the population growth of the city.

And this is where the machines make the difference.

1963 OPERATOR—This is the 1963 counterpart of yesterday's "hello girl" which handles your Madison telephone calls, as seen in the telephone company offices.

The device on the table is one of hundreds of such devices, on racks going from floor to ceiling, which takes care of some 400,000 such calls each day.

Scores of Women

But where are these added people?

Mayer leads the way to one of two long distance rooms, where Miss Batty supervises scores of women in a room just like that of the "hello girls" of yesteryear.

The electronic gadgets sort of outsmarted themselves here, he says.

"We've been able to give the public better service, through automating the local calls and a good many of the long distance calls as well, through direct distance dialing," says Mayer.

"The result has been that the number of long distance calls has increased more than 400 per cent in the last 15 years or so. Not all of them can be handled by automation, such as person-to-person calls, where the operator has to make identification; calls to be charged to a third number; credit card calling, and others.

Operators Increase

And the number of operators on long distance has risen within the last five years by 25 per cent, from 250 to 311.

Don Brady, division operations manager, is proud of the cost to the patron.

"National surveys show that telephone service has risen less than half as much as other prices since 1939," he says. "Today it takes a wage earner only half as much time to earn enough for a phone in his home as it did in the early 1940s."

And that pattern, he is sure, is repeated in Madison.

100,000 Calls Daily

So how about the direct distance dialing equipment that's bringing the increase in human long distance operators?

It's in two of the top three floors added last year and this to the Fairchild St. building, where Nick Guerten is in charge of operations.

"We handle about 100,000 calls per day for an area that produces about half the calls of the state," says Guerten. "How many people do we have? Nine."

That doesn't seem like many, particularly since Miss Batty has said that a long distance operator can handle only about 125 calls per day, since they're more complicated than local calls.

On that basis, there ought to be 800 people up here.

"In the first place," says Brady, "where'd we get 800 people? In the second place, the big increases we've had here are dependent upon auto-

mation. Take it away, increase our charges to the customers, and we'd lose business."

The way long distance is being accepted, says Guerten, they're going to have to double the capacity of his direct distance dialing department next year, anyway.

Better Jobs

And almost certainly Miss Batty'll get more human workers in the jobs that the electronic devices can't do.

The nine people up here are doing jobs that never existed before, says Guerten, and they're among the better jobs and the better paid in the office here.

And Brady adds:

"One of the things you don't see, on the surface, is that we're moving to better jobs, that take more training and pay more money. More men are getting jobs here than ever before.

"When we went to dial, for instance, there were four salesmen on the road. Today, there are 45 going into businessmen's offices and showing them how our service can save them time and money.

Computers Talk

"A dentist's assistant, for instance, can put cards in a phone to ring the numbers of people whose appointments are coming up. A businessman can turn a single dial to a man's name, like you'd dial a record on a juke box, and the telephone will dial the number, in Madison or any place in the country.

"A Data-phone will let one computer talk to another, at the rate of a full book of 50,000 words in 45 seconds, and they predict that one day half of the phone lines will be filled with machines talking to machines.

"But . . . you get the idea."

Okay, let's see these complicated gadgets for direct distance dialing.

Your call comes first to a relay in a sender, says Guerten. It is about the size of a deck of cards, in racks that stretch from floor to ceiling. As the first numbers you dial come in, the relay whips off a message to a "marker" and goes on to take the rest of your numbers and remember them.

Tubes Flash

The marker looks like a Christmas tree of wires and tubes that go upward in Yule tree fashion. The tubes flash dull red in rapid blinks, which indicate that they are searching out the best route for your call and whipping the information back to the sender.

They find a route in half a second, if all goes well, and it usually does. If it doesn't go well, the marker trys a second time, again in a half second.

If it doesn't make it this time, it turns the job over to another marker and issues a call for human help, by flashing a light and ringing a bell to show it's in trouble.

And it is then that one of the men in one of the better jobs shows up.

If the marker is successful, it tells the sender, which then makes your call. Generally no more than 13 to 15 seconds have passed from the time you quit dialing until the bell starts ringing at the number you're calling.

Costs Reduced

"Back in the 1920's, it took an average of 10 minutes to make the call," says Mayer. "You were tempted to shout, because it was the equivalent of talking with someone 80 feet away. Today, with the development of new equipment, it's the equivalent of 6 feet.

"Back then, the call cost you $16.50, if it was coast-to-coast. Today that cost has been cut to $1.75, or $1 after 9 p.m.

"And that's automation for you."

As you stand in this room, electronic devices are doing many another job that people never did do.

Here's a gadget that goes to work at night, checking out 1,500 circuits each night, like elves working for the shoemaker in the storybooks, and leaving a list of circuits where trouble exists for the morning crew when it arrives.

Busiest Circuits Found

Over here relay keys are being depressed, as by invisible fingers, as the movement goes from row to row up to the ceiling. An electronic gadget is trying out the circuits, over and over, to determine which are the busiest, and where more capacity is needed.

Here's a man using a special "gun" to wrap wires around a connection so tight that the man with the soldering iron has lost this job, and been shifted to another. It was invented in the Bell laboratories.

On the other hand, look at all the transistors around. They were invented in the Bell laboratories a decade or so ago. They constitute a $1 billion a year industry, which makes jobs all over the country, including places in Madison outside the walls of the telephone office.

And the Bell system has spent more than $1 billion in research since 1920, and that has meant jobs by the hundreds, too.

Shift to Brains

Here's a microwave panel. Your calls to Dodgeville, Platteville, etc. go out over air waves, not on wires and poles. And what's happened to the man who set the poles, and serviced the wires?

He's lost his job, or a part of it, to the expert who knows the more technical job of caring for this equipment.

And Brady can point out that, in the move to better jobs in the entire telephone system in the country, the shift is to brains and more responsibility.

In the last five years in the nation, plant craftsmen went up by 18 per cent; supervisory employes by 17 per cent, and business office and sales employes by 15 per cent. And the fact that the payroll went up by 34 per cent reflects the better rates the firm can pay and the better jobs that have been created.

Hiring Patterns

This has been accompanied, Brady says, by changes in hiring patterns. The company has learned to cushion automation by hiring temporary help as automation occurs, and depending upon the naturally high attrition in an industry where women predominate, to lessen its impact.

And the firm is paying more attention to the workers who will be permanent. There was a time when a lineman's job was a career job. Today there are more linemen than ever before, but it's generally a stepping stone to a better job.

And the company wants to make sure that the individual they hire has that capacity to go ahead.

Growing Fast

Down in another rack is where the television programs come in, for sending to Madison stations for rebroadcast. This industry got its start on a national network basis through the inventiveness of the telephone system.

It's now a $4 billion a year industry. And that means jobs, lots of them, in Madison and all over the country.

And that's the telephone company for you, trying out every new technique that it can to do a better job faster and at less cost.

And growing so fast that no one, not even the biggest of the computers, can gauge its impact on the economy of Madison and the nation of which it is a part.

V

Concrete Proof of Push-Button Gains

(Sunday, November 28, 1963)

A few years ago, the Janesville Sand and Gravel Co., of Janesville, was casting a speculative look at Madison.

Madison was booming with building. A lot of concrete was needed. They produced sand and gravel for concrete. But how to break into the Madison market with their own ready-mix business?

They found the key in merger and automation.

At the heart of their successful operation, in a merger with the Four Lakes Fuel and Supply Co., is an intricate device called a Butler Bin Model B-1 Push Card automatic batching system.

Push a queerly shaped card into its innards, set a dial or two, and push a button, and sand and gravel starts flowing from bins into hoppers where it's weighed, water and cement are added in just the right proportions, and in 20 seconds or so there's enough material to fill one of those transport trucks you see going down the streets, with its revolving load of concrete.

And it's done with a higher degree of accuracy, they say at Four Lakes, than any human being can do the job alone.

This means a better concrete, they say.

And, as the word gets around, it means more sales.

The man who runs the push card automatic batcher most of the time is Don Storkson, who is highly satisfied with the automatic batcher. He ought to be. It means a lot less work for him.

His "office" is in a little room on high stilts, under which the trucks run to be filled. It is warm. And dry. And he does his work by pushing buttons, rather than running his legs off, as he used to do.

By standing in the door of his "office," he can see the site of his former labors.

It's a big, squarish building between two railroad spur tracks. On one side as many as 16 cars of sand and gravel from Janesville can be unloaded to an underground pit each day. As the materials are unloaded, a

conveyor takes them to the top of the building. There they are channelled to the proper bin, in four grades.

Cat on the Roof

Each bin has a hopper bottom, with a weight hopper underneath. The four bins front on a walkway which Storkson once patrolled on a run.

When he got an order for concrete, he'd figure his proportions, then he'd start one bin to emptying into the weight hopper underneath. Then he'd dash to the next, keeping a concerned eye on the scale of the first weight hopper to make sure that he wasn't getting too much in it, then dash to the third.

It was strictly cat on a hot tin roof.

And if he got too much sand in one batch, he had to make the proper adjustments to get it just right. Then he emptied the weight hoppers via gravity to a conveyor belt below which took it to a mixer. There the water was added and the batch mixed before going to the truck.

It took seven or eight minutes before the concrete hit the truck. And, in addition to Storkson, there was a man on the mixer and a yard superintendent.

Special Card

Today, Storkson gets the order and picks one of the queerly shaped cards off a rack. It has been specially tailored to the customer's needs, by a specialist in Janesville. Storkson slips the card into the automatic batcher, and the card tells the electronic device what proportions of sand, two grades of gravel, cement, water, and whatever additives might be needed for this batch.

He sets a dial for the number of cubic yards he needs. Moisture is critical in concrete, for too much water in relation to cement can rob a batch of strength. So he checks a gadget that tells him how much moisture is in the sand, where most of the water lurks.

He sets a dial to this percentage figure, and now the machine will add just the right amount of water. An amber "Ready to Batch" light glows. He pushes a button, and looks at a bank of lights on his console.

If any of the weight hoppers has been overfilled, a red light for that bin in the upper bank will glow, and the amount will register on a scale above the console. If any weight hopper is underfilled, a light in the second bank will glow. If they're all all right, a bottom row of amber lights will glow.

Catches Error

If there's an error, and it's seldom there is, he can switch the device to manual operation and push a button to fill underfilled weight hoppers, or

set the bins to emptying and stop an overweight hopper at just the right time to hold back the surplus material.

And if he should get careless and overlook the warning lights. the "Batch" button won't depress and he'll have to look for the trouble.

On the average, he can have the concrete batch flowing to the truck in less than two minutes.

"By the use of this automated equipment, we can produce 140 cubic yards of concrete per hour, as compared with 40 yards under the old system," says Goodwin Lyons, Janesville, president of the Four Lakes plant.

"More than that, we're producing a better quality of concrete through virtual elimination of human error. The machine doesn't become preoccupied with its relations with its in-laws, staying out too late at a party the night before, or just plain being tired.

Does Job Faster

"It does the job that humans tell it to do and, assuming that we tell it to do the job right the first time, it does it time after time, without change and faster than a human being can do it."

And what's happened to the human factor?

Well, Storkson is still there, doing his batching from a warm, dry room with a push of the button rather than running up and down the formerly damp and poorly lit room with its bins and weight hoppers.

The man on the mixer in the old plant has lost that job, since the batches are now mixed in transit on new and larger trucks. But he has become the plant foreman.

Work Force Increases

And the man he replaced? He's gone on to become the plant foreman in the Midwest Concrete Corp. on the East side of Madison, a plant which is also a subsidiary of the Janesville Sand and Gravel Co., whose president is Ellis Jensen, also a regent of the University of Wisconsin.

"Actually, the work force in Madison has increased by more than 25 per cent since we went to automation," says Lyons.

"And that increase would not have been possible for us without automation."

VI

Oscar Mayer's Growth Is Automatic

(Sunday, December 1, 1963)

Mention automation at Oscar Mayer and Co., and all eyes turn toward the wiener tunnel.

At the head of the wiener tunnel stands one man, superintending 10 lines of wieners as they march into the tunnel.

A lot of mysterious and highly secret things happen to the wieners as they go through the tunnel, involving trade secrets competitors would like to know.

Hours to Minutes

They're gone from view for some 36 minutes, and then they march out the other end of the wiener tunnel, having completed in the 36 minutes a process that used to take 36 hours.

A couple of men check the marching wieners as they emerge.

And the tunnel in between is doing a job that was once back-breaking work for men.

Where Are Men?

Men used to scoop the meat into grinders, then scoop the ground meat into stuffers. Men used to operate the stuffers. Other men would put the wieners on "trees" and hang them in smoking chambers.

Now they don't. And what's happened to the people who have seen the machines take over their jobs?

Again, it's highly complicated. Again there's been a shift of people within the plant, as much as possible, and a cushioning of the changes through attrition where possible. Research has created new jobs. Yet . . . .

"We had 2,785 men and women in plant production in 1961," says Paul Bowman, Madison plant manager. "That was before the wiener tunnel was in operation. Today we have 2,787—two more."

Union's Concern

Across the street, in the building of the Amalgamated Meat Cutters and Butcher Workmen, Local 538, Cal Rush, the business manager, corroborates this when he says:

"The membership has stayed normal for the last three years, all right. It's now 2,700 in the plant.

"Our main concern, however, is for jobs for women. At lot of women's jobs have been lost, mainly the women who used to skin the wieners. The fact that our membership has stayed the same means that more men, and fewer women, are working at the plant."

This takes us back to the far end of the wiener tunnel, where the 10 lines of wieners march out, at the rate of 25,000 per hour, under the watchful eyes of the two men.

'Squeaky Wrist'

Oscar Mayer used to have some 200 women skinning wieners, jobs which no longer exist. Advancements in wiener technique created these jobs back in 1934, and the newest advancement has taken them away again.

Back in 1934, Oscar Mayer decided to leave the time honored technique of inserting the sausage meat inside a natural casing which was either tough for the customer to chew or hard to remove.

Mechanical Knives

They developed a cellulose material which could be stripped off before the wiener was sold to the customer. This job required women. It was tedious and monotonous, but it was a job. Women developed something they called "squeaky wrist," which was painful. And Oscar Mayer wanted a better process.

So now as the marching lines of wieners come out of the wiener tunnel, 10 sharp little knives slit their casings, and there have gone the jobs for the women.

More than that, a few years ago the quick fingers of women used to pick up the wieners and put them in a package, loosely packed and shippable only moderate distances.

Today, at the far end of the wiener tunnel, the wieners march along their production line to where vacuum gadgets drop down on them, pick them up 10 at a time, and put them in trays marching off at right angles and into a complicated device which automatically vacuum packs them in plastic wrappers.

In the process, there are 10 less jobs for women than there used to be.

"And now we can ship them to much more distant markets," says Bowman. "Their shelf life is much longer. That means more work for this plant and more jobs for Madison people, buying the materials from the farm, trucking them to market, packing the product on cars for shipment, selling it to customers—there just isn't any end."

The women aren't at the end of the wiener tunnel, but new jobs have been created and old jobs enlarged.

And who can say exactly where the gain and loss is?

More Production

Rush, the labor man, points out that while the labor force hasn't been cut, there's a lot more production. And this new production is being accomplished with fewer people. The loss isn't so much in present jobs as the jobs of the future that the machines—not people—do.

The net sales of the company indicate growth. They were $270 million in 1962 as compared with $209 million 10 years before, or 29 per cent higher.

But they reflect the entire Oscar Mayer operation, with six plants and 15 distribution centers about the country.

Other Products

A more accurate figure, Bowman feels, is the plant production, where his figures show a 5 per cent rise.

And Rush points out that a part of the impact of the loss of women wiener stripping jobs has been taken up by the facts that the farmers are selling their meat animals the year 'round, and that Oscar Mayer is making more cold luncheon meat, more sausages in Saran plastic films.

Research Effort

To this, Oscar Mayer says, "Amen, and we planned it that way. It didn't just happen."

Back in 1941, Oscar Mayer established its first research laboratory in the Madison plant. They came up with the Chub pack machine for meats and sausage in 1949; the slice-pack for cold cuts in 1950, and the famous Smokie links in 1951.

All of them have created jobs for people in Madison.

And, probably more important, they have created a stability of work force.

"When I first came here," says Bowman, "it was normal to lay off 200 or 300 men at a crack, when the winter heavy kill had ended, for instance.

Summer Work

"So we sought out a means of creating summer work, so that we could keep people the year around. It's worked out quite well."

He stops, on a tour of the plant, at a Chub pack machine. Liver sausage under pressure, is coming out of a stainless steel tube and automatically being packaged in uniform plastic tubes.

"The machine does the work of the man who used to fill the stuffer, and the man who filled the casing, and the man who washed it and more," says Bowman.

Larger Market

"On the other hand, it means that we now can ship our product farther. When this company started in Chicago, back in 1883, the business was limited to the immediate neighborhood and a few miles beyond.

"Today, we're shipping these Chub-packs all over the nation, and to the military in Japan and Germany as well."

The new packing procedures mean that Oscar Mayer, which had been setting up packing plants in many parts of the country so that they'd be close to the people who'd eat their product, have now begun reversing this procedure.

The result is that there is more production coming back to Madison and more jobs here.

Machines Patented

But aren't there other jobs lost elsewhere by companies not as aggressive as Oscar Mayer? Possibly, but . . . who knows?

And another feature is that Oscar Mayer has patented some of these machines invented in their plant. Those plastic tubes of cookie dough you see on the grocery shelves are made on machines which saw the light of day thanks to Oscar Mayer.

They're creating more jobs, but how many no one can say.

There's another side to automation at Oscar Mayer and Co.—in the business office where computers whip through jobs in split seconds that once took hours or days.

There's a room filled with girls wearing telephone headsets, taking orders from salesmen working with 40,000 customers throughout the country. Here's an order from Philadelphia, for instance. The girl touches keys of a machine as the salesman "talks in" the order. A card comes out of the machine.

Electronic Orders

It goes to the next room, where a computer awaits. It whips out the order quick-as-a-wink in duplicate, printing the name of the customer, what he wants, how much of it he wants, and all the rest. The shipping room gets the order far faster than ever before. And the machine adds up the cost of so many wieners at so much a pound, etc., and gives the final total.

More than that, the computer is "remembering" all of the transactions. At the end of the day, it will tell the firm just how much of what they sold and at what prices.

Cost Figures

Nor is this all. During the day, they're adding all the costs of production into the machine. And at the end of the week, the machine will tell them the profit and loss on the entire operation.

It'll give them the profit and loss of each salesmen's route. It'll tell them what price they ought to pay for what cuts of meat. And, if they see a competitor without a computer paying too much, they just stay away from that particular meat.

In between times, it figures the payroll, and it makes adjustments in the recipes for such products as Smokie links so that each batch of meat—which differs from every other batch—will come out tasting the same.

Furthermore, the computer makes a lot of formerly executive decisions for the firm.

"We simply set up an acceptable range of decisions, and the computer makes them," says Bowman. "This weeds out a lot of the simpler decisions, and leaves humans more time for the more complicated ones."

Bigger Memory

The computer used to get along on a memory core capable of storing 20,000 bits of information. Now the old core stands in a corner, and a new memory with a capacity of 40,000 bits of information is going in.

The electronic gadgets, in their last improvement, do the work of 15 women. With a 15 per cent turnover each year, it's easy to make the change without much of any fuss through attrition. The jobs are gone. But . . .

"The profits in the meat packing industry are traditionally small," says Bowman. "In the entire industry, an average of eight-tenths of 1 per cent of each dollar of sales represents the net income.

Industry Leader

"Oscar Mayer last year netted 1 and six tenths of a cent per $1 sales to lead all the industry. We have led it for nine years, and it looks like the 10th year is coming up. This means that we can put more money into research and into equipment.

"And that, in turn, means that we can do just that much better job for our customers, for our stockholders, and for the people who work at our plant."

VII

Labor Looks at Automation

(Thursday, December 5, 1963)

Madison labor looks at automation from the standpoint of people more than any other group in the city.

For them, automation means a worker who has put in 25 or 30 years on the same job standing before the desk of a union business agent and explaining that a machine is now doing the work he used to do, and . . . where does he go from here?

"You can talk all you want to about automation being the harmless successor to the Industrial Revolution, the easy retraining of employes to better jobs, and the better life to come," says Marvin Brickson, president of the Madison Federation of Labor, AFL-CIO.

"But this is today, and here's a human being, with kids in school and a mortgage on his house, and there's nothing else that he can do."

Perhaps he should have gone to the Vocational school and learned new skills. But he didn't. And now he's out of work. Today.

Not As Hard Here

Fortunately for Madison, automation isn't hitting Madison's blue collar worker as hard here as it is in other places. For one thing, there aren't as many here as there are in other towns.

But labor here is fully aware of such statements as those of John I. Snyder, chairman and president of U.S. Industries, Inc., who says:

"Some four million of our people, or 5.5 per cent of our labor force, are without jobs. More than 2.5 million have completely exhausted all their employment benefits.

"At least one out of five people working today will almost certainly be unemployed some time during next year and upwards of 2.5 million will have to settle for part-time jobs because no full-time work will be available to them."

This sounds grim, and all the more so since Snyder is the chief executive officer of one of the country's leading manufacturers of automated

equipment for industry, trying to find a way to cushion the effects of the machines he's making.

'Quiet Firing'

"He says that 40,000 jobs are being eliminated by what is called 'quiet firing,' " says Brickson. "Actually, no one's fired. A person may be moved to another job in a growing business. He may be kept at his same salary on the new job that the machine is doing, but not replaced when he quits or retires. But then the job is gone."

And this, he says, is happening in Madison as far as many blue collar workers are concerned.

"Some of the union contracts being written in Madison now contain automation clauses," says Brickson. "The first one was the one for the Office Employes Local No. 39. But, while you can write into a contract that no one now on a job will lose that job, or lose a job with the same wages, because of automation, so far no one's written a contract that guarantees that that job will be filled in the future.

"And that's the danger of silent automation."

White Collar Jobs Hit

The Office Employes union, he says, contains some 300 or more members who work mainly for Madison Gas and Electric Co., CUNA Credit Union, and CUNA Mutual Insurance Society.

"In all the talk about automation and the blue collar worker, some people tend to forget that automation is hitting the white collar worker as well," says Brickson.

"At the heart of many job losses through automation, or silent automation, is the computer, and many of the jobs lost are in government work. When the United States Census was taken in 1950, it took 4,100 statisticians. By the time that the 1960 census was taken, many more computers were in operation and it took only 50 statisticians."

The reason he emphasizes this, he says, is that Madison—with its federal, state, county, and city pay rolls—has a lot of government employes.

"There are 85,400 non-farm members of the Dane county work force," says Brickson, "and 29,100—or more than one-third—are in government work."

The computers, he says, are causing a shift in the proportion of jobs held by women.

Team Solution Urged

The answers to the question of how to live with automation, he feels, must be sought by government, industry, and labor as a team, for no one can do the job alone.

And he feels that the benefits of automation, from the profit standpoint, will have to be spread past industry and to the workers in the form of shorter work week, longer vacations, increased pensions, and pensions at an earlier age.

The steelworking industry, he notes, is now granting 13-week sabbaticals every five years to senior workers, and the 35-hour week is more and more widely accepted.

In Madison, the 37½ hour week is entering the picture, but Brickson points out that it's been a long time since the last full five-hour drop in the work week.

"The 40-hour work week is now 30 years old," he says. "It came into the picture in 1933. Before that, the drop had been about five hours each decade back to the first of the century when the painters, for instance, worked as much as 70 hours a week.

"Their first contract here in Madison, for instance, was a 60 hour week and 20 cents an hour."

Twin Brother

Though automation has not had too much effect on many of the union men in town, its twin brother—technological change—has.

The carpenters are getting only about 60 per cent of the man-hours you'd expect, he says, due to such changes as power saws, power nailers, pre-hung doors, windows that come in units, and the like.

The need for common laborers has been tremendously reduced by cranes that lift materials once carried by men to the tops of buildings, power shovels that lift tons instead of pounds, or pumps that push plaster through pipes instead of having the man with hod carry it.

A typical story of technological change is that of Harold Rohr, business agent for the Painters Local Union 802.

"Take a look at the State Office building out at the Hill Farms" says Rohr. "We ought to have 15 or 20 men on that job for six months. What'd we have? Three for 11 months.

"Madison union painters got 33 man-months of work, instead of 120. Instead of working 10½ to 11 months a year, our painters are working around seven months.

"Sure, they make $3.73 an hour, but they average only about $5,000 a year."

Pre-Finished

What's making the difference?

"Everything's going pre-finished or plastic," says Rohr. "We used to paint a whole room. Now the floor is pre-finished tile, and the baseboard

is rubber and doesn't need a finish. The windows are aluminum and don't need paint, and the trim may be prefinished. The ceiling is probably acoustic tile, and finished. We're lucky to get from one to three side-walls to paint."

The painters local is attempting to get local suppliers to put in their prefinishing plants but, "it's rough when you have to compete with somebody getting maybe $2 an hour in a plant up at Wisconsin Rapids," says Rohr.

More than that, they're becoming acutely aware of the need for more education and better education for labor.

"There was a time when the strong back was all you needed for a job," says Brickson. "Well, it's no guarantee of a job today."

There are a limited number of apprenticeships open. The labor groups have set-up a high school diploma as one requisite to getting the best people for these few jobs.

"And that makes it tough on the high school drop-out," says Brickson.

VIII

Automation Vital to Insurance Firms

(Sunday, December 8, 1963)

Insurance is a big business in Madison.

There are 27 companies with home offices here. They employ thousands of persons directly; they give indirect employment to thousands more.

Automation is coming to these Madison companies on a big scale.

American Family Mutual Insurance Co. has a big room filled with electronic devices which are doing jobs that people used to do. They take automation pretty calmly.

Competitive Matter

For one thing, the insurance business is highly competitive. If they didn't use more machines, their competitors would and they'd suffer. Their employment would suffer, too, they say.

Since 1942, when the firm quit the old hand ledgers for the newest and best mechanical equipment, they've been growing.

"In 1942, we had an even 100 employes," says Robert Kelliher, director of office administration. "Today we have 820, in spite of all the labor saving machines we've added."

The newest change came a year ago in the form of an IBM 1410 computer which added 8,000 five-digit figures a second.

Sophisticated Gear

"A few years ago, we saw that we were going to have a problem getting out the work we could anticipate in another several years," says Kelliher. "Our RAMAC system just wasn't fast enough. To expand it would require another 55 clerical persons.

"And even then, our competition, with more sophisticated machines, would be able to do the work at a lower cost, and do a better and faster job for the customer in speed of work, accuracy, and the new types of policies for which rates could be so easily calculated on the new machines."

He gestures to the main work room of the insurance firm, where virtually no one's using a bookkeeping machine.

"We'd have to have that whole room filled with girls at bookkeeping machines and typing," he says, "if we didn't have this—computer and high speed printer."

Swift Printing

The printer takes about as much room as a desk at which a single typist would sit. It prints renewal notices, new policies, amended policies, and premium notices quite rapidly.

It prints typed material at a rate of 1,300 letters a second.

But how about the 55 clerical workers whose work the machines are now doing?

"Our growth has been such that no one has been laid off because of the machines," says Kelliher. "There's been shifting of jobs, but no separations of people from jobs."

Taped Information

Furthermore, says William Werner, supervisor of electronic data processing at the firm, the computer enables them to keep on top of their job as they never did before.

"These eight reels of tape," he says, "contain all of the vital information on our 760,000 policies—the name of the insured, his address, the name and year and model of his car, what coverage he has, and all the rest.

"The information is constantly changing, as you might expect. Among 760,000 insureds, there is constant changing of addresses, automobiles, coverage, and all the rest. And these master controls are up to date within hours."

How It Works

How's it done?

Each day, the 1,500 agents of the company write or phone in changes, along with new policies or orders to drop old policies. Underwriters decide whether to accept the new policies. Rates are applied. The information is punched into cards in code form. The cards whip through a machine, and a work tape comes out.

The master tape goes onto one machine, and the work tape on another. A new master tape emerges, with all the changes made.

"In three hours and five minutes, the entire job is done," says Werner. "By the next morning, we're up to date as of 4 p.m. the day before."

Premium Notices

The computer does a lot more than that. As it encounters a new policy on the work tape, it whips the information off in a new direction to emerge on a tape of its own.

Girls used to type out these policies, but now the high speed printer does the job.

The computer also takes care of premium notices amending policies, changing your address or makes of cars, or renewal notices.

There also is a machine in St. Joseph, Mo., that talks to a machine here. American Family has a regional office in St. Joseph, and the St. Joseph office has a teleprocessing machine.

Telephone Report

They fit the day's business, in the form of punched cards, into the machine in St. Joseph. Electronic impulses travel a telephone line to Madison, and a similar machine in Madison punches identical cards here for the computer to work with.

Nor is this all. The computer assembles all sorts of information on command. If you want to know how much the losses are on 1954 Ford cars driven by rural youths between the ages of 18 and 21, the machine will tell you.

We're able to pinpoint losses so we can establish the highest premiums where they belong and, conversely, give the best possible rates to those good drivers of good cars who should get the benefit," says Kelliher.

They get the information in hours, instead of months, this enables them to beat competition or, at the least, keep up with it.

Programmers' Jobs

Telling the machine what to do is a job that requires the services of four people called programmers. It is an intricate job, and time consuming. The instruction to the computer to tell it what to do with the master tape, for instance, took most of one year for one man.

But has the mechanization resulted in long lines of women, particularly, at the personnel office, seeking jobs?

"Not that I notice," says Norbert Vanden Heuvel, personnel director. "Our basic requirements haven't changed much in recent years, and the numbers of persons seeking jobs has changed little in pattern."

Jobs Available

Just to make sure that the experience was general, a check was made with Clyde Selix, partner in Placements of Madison and Girl Friday.

"There's a shortage in Madison of well-qualified women for white collar jobs," says Selix. "One reason may be that, since World War II, the requirements for women may have been relaxed to the point where they've let training slip, or they just don't produce.

"The girl, however, who has a sense of responsibility, is an even moderately good typist, has a good job history, can spell, can punctuate, and can set up a letter by herself when the boss says, 'Tell Joe politely we don't want any' isn't going to have any trouble getting a job in Madison."

"As a matter of fact, if she can't get a good job in a week, she'd starve to death at a free picnic."

EXCERPT FROM STATEMENT OF WALTER P. REUTHER, VICE-PRESIDENT, AFL–CIO, BEFORE SUBCOMMITTEE ON EMPLOYMENT AND MANPOWER, MAY 22, 1963

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THE ACCELERATING TECHNOLOGICAL REVOLUTION

The accelerating technological revolution brooks no delay in establishing a comprehensive manpower policy and program. The pace of change in the labor market is determined mainly by the pace of technological advance. With more rapid change in technology, there is corresponding acceleration in the rate at which changes occur in educational and skill requirements for employment and in the kinds of jobs available and the places where they are available.

Thus the extent of the labor market adjustments with which we must cope today are greater than they were yesterday and will be still greater tomorrow. In consequence, the need to develop and implement an effective manpower policy becomes daily more urgent.

This need is underscored by the evidence that productivity, which reflects improvements in technology, has tended historically to accelerate. The attention of economists has only recently been attracted to the phenomenon of acceleration. For too long they misled themselves and the public by projecting productivity into the future on the basis of the long-term average rate of past productivity gains. In so doing, they ignored the fact that their averages were a combination of relatively low rates in the distant past with significantly higher rates in more recent years. Their projections, therefore, underestimated future productivity gains and contributed to complacency toward the magnitude of our full employment, economic growth, and manpower adjustment problems.

But there is increasing recognition among responsible scholars who have taken the trouble to look at the facts that, if we take past rates of productivity advance as our guide to the future, we will be badly in error. They recognize that acceleration of the rate of productivity advance goes far back into human history; and assurance that acceleration will continue for some time to come is given by such factors as enormous increases in expenditures on scientific and technological research, rising levels of education, major technological breakthroughs exemplified by automation, and the application of computers and atomic and solar energy to industry.

The late Prof. Sumner Slichter was among the first to recognize the strong tendency of productivity to accelerate. In the book, "Economic Growth in the United States," published after his death, he wrote:

"Although statistics on production are available for only about the last century or century and a half, it is evident that during most of the world's history output per man-hour must have been growing very, very slowly or not growing at all. This conculsion can be demonstrated by projecting backward various rates of growth. Unless an extremely slow rate of growth is used, the backward projection soon gives amounts of productivity that are unrealistically low—in fact, so low as to be insufficient to support life."

By contrast, he pointed out:

"During the first half of the 19th century, productivity per man-hour in the United States may have increased as much as 25 percent. In the second half of the century, it doubled, and in the first half of the 20th century it almost trebled."

Focusing on relatively recent periods, Solomon Fabricant, Director of Research of the National Bureau of Economic Research, noted the same phenomenon in the Bureau's 1959 annual report. He wrote:

"Also a fact of great importance, the long-term pace of advances in output per man-hour has speeded up. It was 22 percent per decade during the quarter century preceding World War I. It has averaged 29 percent since. During the most recent period—after World War II—national product per man-hour has been rising at an even greater rate, 35 to 40 percent per decade."

The degree of accleration in productivity during this century becomes apparent from statistical trend analysis of BLS figures on output per man-hour worked in the U.S. private economy as a whole which covers the period 1909–62. Such analysis, made independently by BLS and by the UAW's technicians, show that, despite the retarding effects of recessions and wars, there has been strong and persistent acceleration in the "normal" rate-of-productivity advance—from a rate of 0.9 percent a year in 1909 to approximately 4 percent today.

It is significant that, during the period of relatively full employment from 1947 to 1953, productivity in the private economy registered an actual increase averaging 4¼ percent a year. The lower rates of more recent years undoubtedly reflect the repeated recessions and persistent economic slack of the years since 1953. As the Manpower Report of the President cautiously notes:

"Although the statistical data on this subject are too limited to warrant definitive conclusions, it is probable that underutilization of plant, equipment, and manpower resources has had a significant effect in retarding productivity gains since the mid-1950's."

Under the stimulus of automation and other revolutionary technologies, there can be no doubt the historical tendency for productivity to move forward at an accelerating pace will continue into the foreseeable future.

[From Manpower Report of the President, March 1964]

PRODUCTIVITY, CHANGING TECHNOLOGY, AND EMPLOYMENT

The persistent high levels of unemployment have evoked wide concern as to the pace of technological change and its effects on employment opportunities. This concern is occasioned by knowledge of the employment cutbacks which have attended the changeover to automation in some plants, and by frequent reports of new and improved devices which could be substituted for human labor in ever-widening areas of activity. Yet automation is generating jobs as well as eliminating them—in part through direct creation of new jobs, in part through stimulation of economic growth. And it can be convincingly argued that, according to the record of economic history, the longrun effect of technological advance has so far been to increase employment, as well as to raise per capita income, and to remove much of the drudgery from work. The most recent phase of technological progress may well have similarly favorable longrun consequences.

Two basic propositions are generally agreed upon in considering these and related questions: First, that continued rapid technological progress is essential to the economic strength of the Nation and to the achievement of further advances in levels of living for the American people; and second, that the brunt of the adjustment to technological change should not continue to fall on individual workers and their families but must be shared by society as a whole. The steps required to minimize and mitigate the dislocating effects on individuals must be resolutely taken—by employers, unions, Government agencies, and other concerned groups.

In planning both overall economic policy aimed at stimulating employment growth and measures to amerliorate the adjustment problems for workers affected by technological change, factual information on the current pace of such change and its present and prospective impact on employment and occupational requirements is of obvious importance. This chapter represents a first progress report on findings of the Department of Labor's recently expanded program for assessing the available data on these subjects and for developing the body of statistical and other information needed with regard to them.

In this discussion, technological change is regarded as embracing all the many types of innovations which result from the application of scientific and engineering knowledge and techniques to the processes of production and distribution. In general, the purpose of such change is either the production of new or improved goods or services, or greater efficiency of operations and consequent cost savings.

The term "automation" has been given widely varied meanings by different authors. This coined word, derived from "automatization," was used originally to denote certain technical innovations in metalworking industries, involving mass-production machinery with a high degree of automatic operation. Later, the term was applied to electronic computers and to automatic control devices which can measure and adjust performance. These developments are often cited as examples of the advanced stage of technology where mechanisms are used in place of human labor to monitor as well as perform work. It is in this general sense that the term is used in the present report.[1]

Both theoretical and practical difficulties have so far prevented the development of direct statistical measures of technological change—except for a few types of innovations (notably, electronic computers, on which statistics are presented later in this chapter).[2] In efforts to assess the pace of such change, reliance has therefore to be placed on analysis of related statistical series, descriptive data, or a combination of the two.

Among the most important indirect indicators of the rate of technological change are the indexes of man-hour productivity issued by the Department of Labor for many years. Though influenced also by a variety of other factors—including production levels, changes in capital investment per worker, education, and the skills of the work force—the rates of change in productivity provide valuable insights into the pace of technological progress in American business and industry.

PRODUCTIVITY TRENDS

Total private economy

Productivity (output per man-hour) in the private economy of the United States rose at an average rate of 2.4 percent a year over the half century covered by the index 1909–63.[3] During the postwar period 1947–63, the increase averaged 3 percent.

The increase for the past 3 years, 1960–63, averaged 3.6 percent. While this is a relatively high rate for a 3-year period, it should be noted that the private economy has achieved equal or higher 3-year rates several times in the past. In the immediate postwar readjustment years 1947–50, productivity rose at an average rate of 4.3 percent. And in the years 1952–55, the rate of gain was again relatively high, 3.3 percent.

Another reason for caution in drawing conclusions from the productivity gains of the past 3 years is that, if the period covered by the analysis is extended, the findings appear substantially different. For the period 1958–63, the average increase in productivity is estimated at 3.1 percent, little above the 3-percent average for the entire postwar period.

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[1] In contrast to this meaning, a definition of automation as "a new way of organizing and analyzing production, a concern with production processes as a system, and a consideration of each element as part of the system" was recently given by a leading expert. Furthermore, the meaning of the term is often extended popularly to cover all types of technological change, including labor-saving machinery of conventional as well as advanced design, and the application of scientific management methods. So broadly defined, automation becomes a loose abstraction, standing for the far-reaching impact of technical change on American industry and manpower.

[2] See p. 53.

[3] Output per man-hour here refers to the constant dollar value of goods and services produced, in relation to the hours of all persons employed (including proprietors and unpaid family workers). The output concept is consistent with that of gross national product and is measured in terms of 1954 dollars. The man-hours are based primarily on establishement reports to the Bureau of Labor Statistics. Another series of estimates of output per man-hour have also been developed, based on man-hour data from the labor force statistics. In general, the two series show similar movements over the postwar period.

Year-to-year changes in productivity are more closely related to changes in production levels than to any other factor. In general, the largest gains are registered in years of upswing in the business cycle. The rise in output per man-hour was sharp in the recovery years 1950, 1955, 1959, and 1962. (See table 9.)

TABLE 9.—*Year-to-year percent change in output per man-hour,*[1] *1947–63*

Period	Total private economy	Agriculture	Nonagricultural industries	Period	Total private economy	Agriculture	Nonagricultural industries
1947–48	3.5	18.7	2.1	1955–56	0.1	2.2	−0.4
1948–49	2.9	−4.7	3.7	1956–57	3.5	6.7	2.8
1949–50	7.2	13.9	5.3	1957–58	2.5	9.3	1.8
1950–51	2.5	−1.1	1.6	1958–59	3.6	−.2	3.6
1951–52	2.2	9.2	1.3	1959–60	1.9	6.3	1.6
1952–53	4.1	11.3	2.7	1960–61	3.3	5.9	2.9
1953–54	1.8	7.2	1.6	1961–62	3.9	3.4	3.8
1954–55	4.5	3.6	4.3	1962–63 [2]	3.5	7.4	3.0

[1] Output refers to gross national product in constant dollars. The man-hour data are based primarily on establishment reports to the Bureau of Labor Statistics.
[2] Preliminary.

The generally rising trend in productivity which underlies these cyclical swings —which has been a major element in the country's economic growth and the rising standard of living—is the outcome of a variety of factors.[4] Among these are technological advances, capital investment, and scientific and engineering research and development. These factors have a complex interrelationship. Advances in technology are made possible by research and development but are realized through capital investment. Growth in capital spending is stimulated, in turn, by the opportunities for more efficient operations and new and improved products provided by advances in technology—with the total effect of increasing productivity.

Over the long run, education is also an important factor in productivity gains and the country's economic expansion—through its contribution to scientific and technological progress and the quality of the labor force. Recent private studies have emphasized education's contribution to our ecomomic advance to date. One such study found, for example, that two-fifths of the increase in real product per worker over the period 1929–57—a gain of 56 percent—could be attributed to increasing formal education.[5]

The influence of education on productivity is longer term and more indirect than that of the other factors mentioned. It is brought to bear, in large part, as highly educated administrators effect improvements in organization and operations, and as the knowledge of scientists and engineers is realized in technological progress.

On the other hand, advances in education and productivity are mutually reinforcing. As productivity rises, the higher incomes that are generated help young people to stay in school longer and make it easier for experienced workers to leave the labor force for further education or training. Through the increased knowledge and skills thus acquired, these workers and potential workers can then contribute to further gains in productivity and economic growth.[6]

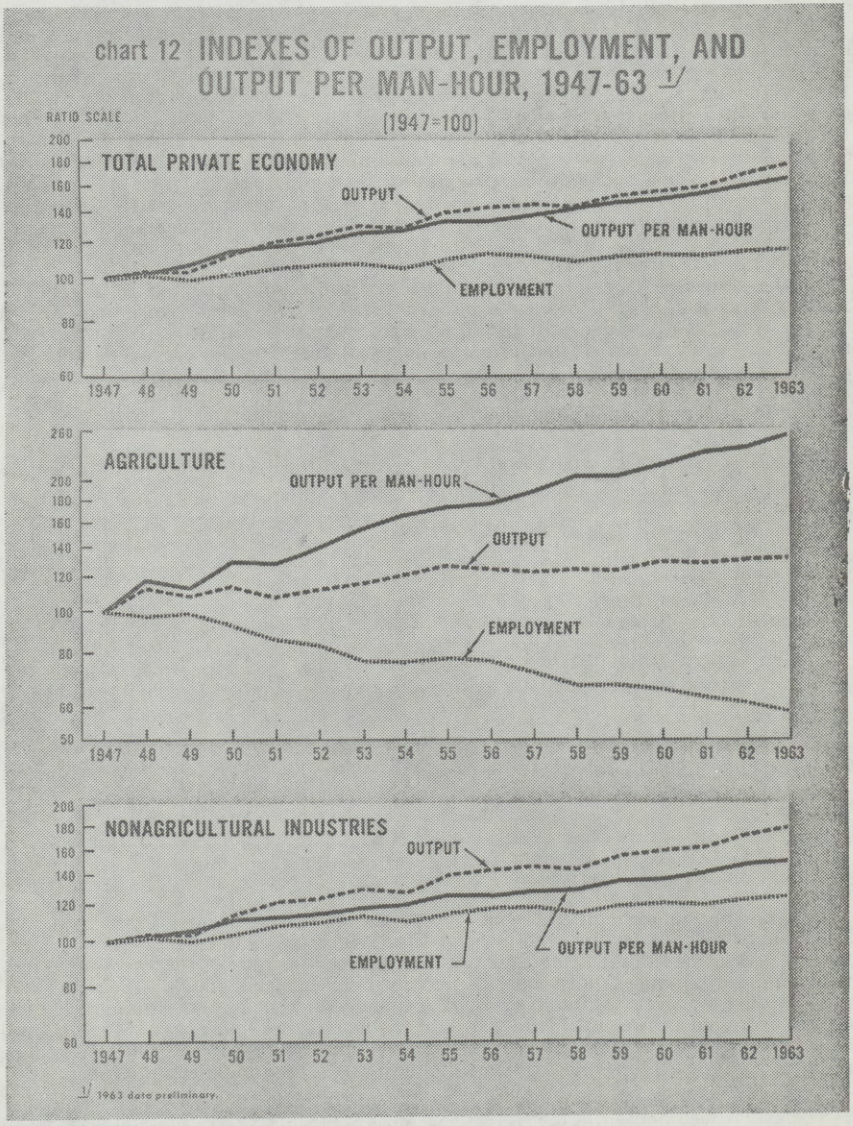
Industry sectors

The great differences in productivity trends among the various sectors of the economy reflect, in large measure, the widely varying rates and character of technological advances in these sectors, as well as fluctuations in production levels,

[4] For a more extensive discussion of these factors, see the 1963 "Manpower Report of the President," pp. 73–76.
[5] "The Sources of Economic Growth in the United States," Supplementary Paper No. 13, Edward F. Denison, Committee for Economic Development, January 1962, p. 73; and hearings before the Subcommittee on Education, Committee on Labor and Public Welfare, U.S. Senate, 88th Cong., 1st sess., Apr. 29–30 and May 1, 1963, vol. 1, p. 408.
[6] Closely related to the rising educational level of the population and hence to productivity gains is the increase in total expenditures for education in the United States. Expenditures for education as a percent of national income dropped considerably during the depression and war years of the 1930's and 1940's, but have climbed steadily throughout the postwar period. The 1962 figure of 7 percent of the national income devoted to education compares with a 1929 figure of 4.7 percent.

changes in production capacity, and other economic factors having a differential effect on different industries.[7]

Agriculture has, in the postwar period as a whole, outdistanced the nonagricultural economy in productivity gains. (See chart 12.) The average annual increase in farm output per man-hour from 1947 to 1963 was 5.7 percent, an extremely high rate for such a long period and just under 2½ times the corresponding postwar average (2.4 percent) for all nonfarm private industry.



[7] It will be noted that the discussion of productivity in this section, as in the preceding ones, is limited to the private economy since no satisfactory method has been found for measuring productivity in the Federal Government. However, a positive and vigorous effort to devise ways to measure productivity and to improve manpower utilization is being made within the executive branch of the Federal Government, and examples of dramatic increases in productivity in a number of agencies can be cited. See "Examples of Improved Manpower Management Plans, Programs, and Accomplishments Developed by the Departments and Agencies of the Federal Government During the Fiscal Year 1963," Subcommittee on Manpower Utilization of the Committee on Post Office and Civil Service, 88th Cong., 1st sess., Oct. 16, 1963.

Rapid and widespread technological advances of many kinds—in farm machinery, fertilizers, pesticides, crops, and livestock—are the basic reason for this productivity record.[8] But other factors have also had a sharp effect, especially on the short-run fluctuations in farm productivity.

Annual productivity changes tend to be much more extreme in agriculture than in the rest of the economy. (See table 9.) During the past 5 years, the changes have ranged from a gain of 9 percent in 1957–58, to a loss of 0.2 percent in 1958–59, to gains of around 6 percent in the following 2 years, and finally to one of 7.4 percent in 1962–63.

Because of these wide yearly fluctuations, modifications in the underlying trend of farm productivity are not easily discernible. Nevertheless, there does seem to have been some slowing down in the rate of productivity growth in agriculture. During the last 6 years, the average annual rate of increase was 4.9 percent, compared with 5.7 percent over the postwar period 1947–63.

From the manpower viewpoint, however, the most important fact about farm productivity is that it continues to rise much more rapidly than total farm output From 1957 to 1963, agricultural production rose at an annual rate of only 1.3. percent, little more than a fourth as fast as output per man-hour. In consequence, farm employment declined (by about 3.3 percent per year). Aggregate farm man-hours went down slightly more (by about 3.4 percent per year), probably because of a decline in the workweek.

In the nonagricultural sector, productivity growth has moved in much the same way as in the total private economy, of which this sector comprises such a large part. The average annual increase in output per man-hour was high in nonagricultural industries in the early postwar years, then slackened, and has risen again in recent years. For the entire postwar period 1947–63, the average rate was 2.4 percent. From 1957 to 1963, productivity gains in this broad economic sector averaged at least 2½ percent. (See table 10.)

TABLE 10.—*Average annual percent change* [1] *in output* [2] *per man-hour and related data, 1947–63*

Item	1947–63	1953–63	1957–63
Total private economy:			
Output per man-hour	3.0	2.8	3.1
Output	3.4	3.0	3.5
Employment	.8	.6	.6
Man-hours	.4	.2	.4
Agriculture:			
Output per man-hour	5.7	5.0	4.9
Output	1.4	1.0	1.3
Employment	−3.3	−2.9	−3.3
Man-hours	−4.1	−3.8	−3.4
Nonagricultural industries:			
Output per man-hour	2.4	2.4	2.8
Output	3.6	3.1	3.6
Employment	1.4	1.0	1.0
Man-hours	1.1	.7	.8

[1] Computed from the least squares trend of the logarithms of the index numbers.
[2] Output refers to gross national product in constant dollars.

Within the nonagricultural economy, some industry groups have achieved much more rapid gains in productivity than others (as shown in table 11). In mining and in communication and public utilities, the rate of increase in output per man-hour averaged more than 3.5 percent per year from 1947 to 1962. (Data for 1963 are not yet available.) In transportation the annual productivity increase averaged between 2.5 and 3.5 percent over the postwar period as a whole, but during the last 5 years, 1957–62, rose to more than 3.5 percent. All these industry groups are notable for extensive and rapid technological advances.[9]

[8] See the 1963 "Manpower Report of the President," pp. 73–74.
[9] The major technological developments in communication and transportation are discussed later in this chapter. See also the 1963 "Manpower Report of the President," pp. 74–75.

TABLE 11.—*Approximate percent change in output per man-hour, by industry, 1947–62* [1]

Industry	Average annual increase		
	Under 2.5 percent	2.5 to 3.5 percent	Over 3.5 percent
	1947–62		
Agriculture			X
Mining			X
Manufacturing		X	
Construction	X		
Trade	X		
Finance, insurance, and real estate	X		
Transportation		X	
Communication and public utilities			X
Services	X		
	1957–62		
Agriculture			X
Mining			X
Manufacturing		X	
Construction	X		
Trade	X		
Finance, insurance, and real estate	X		
Transportation			X
Communication and public utilities			X
Services	X		

[1] These estimates of output per man-hour are based in part on estimates of output (GNP) published by the U.S. Department of Commerce in Survey of Current Business, September 1963. Exact averages are not shown because the output figures will be benchmarked next year to the 1958 input-output table and are, therefore, still preliminary. 1963 data are not yet available for these industry groups.

The broad field of manufacturing ranks next in rate of gain in productivity, with an average annual increase between 2.5 and 3.5 percent over the past 5 years and also the past 15 years. It should be emphasized, however, that this moderate productivity record for manufacturing as a whole is the outcome of a great diversity of technological developments and of economic and other factors which have a differential effect on different industries. The statistical information so far available does not permit quantitative comparisions of the progress in productivity and technology in the various major branches of manufacturing. However, some industries—for example, the manufacture of synthetic fibers and petroleum refining—are known to have been leaders in the introduction of new technology and the achievement of increased output per man-hour, whereas in some others—for example, apparel and shoe manufacturing—technological changes have been limited in recent years.[10] Such gains in productivity as have been made in these two industries during the postwar period have largely resulted from better organization of production and other nontechnological factors.

The remaining industry divisions—construction; trade; finance, insurance, and real estate; and service industries—have all made relatively small gains in productivity. For each of these industry groups, the average annual increase in output per man-hour is estimated to have been less than 2.5 percent both during the 5 years 1957–62, and over the entire 1947–62 period. It should be noted, however, that these productivity estimates were obtained by output measures consistent with the data on gross national product. For some sectors of the private economy—particularly those producing services rather than goods, where productivity gains are shown to be smallest—there are some questions about the adequacy of the data to fully reflect real changes in output.

Automation and other recent technological innovations have made headway in a few individual industries within these broad groups. The insurance industry, for example, has been a pioneer in the application of electronic data processing (EDP) to massive clerical operations, and more banks are now converting to EDP systems. New materials-handling devices are also being widely installed

[10] The regional conferences on industrial modernization, now being sponsored by the Department of Commerce to stimulate growth in lagging industries, may have important manpower implications.

in warehousing operations in retail and wholesale trade and other industries.[11] But despite these and other examples of technological progress which could be cited, it appears that technological advances have progressed relatively slowly in these industry divisions.

It is noteworthy also that the industry divisions where productivity gains have been slowest are those which expanded their employment over the 5 years 1957–62. Thus, trade had an average annual rate of employment growth of 1.2 percent from 1957 to 1962; finance, insurance, and real estate, 2.5 percent; services and miscellaneous industries, 2.6 percent; and the contract construction industry 0.3 percent. Manufacturing, with an intermediate rate of increase in productivity had a slight downward trend in employment over the 1947–62 period. And in the industry divisions with the most rapid productivity gains, employment decreased more definitely—by 4.0 percent per year in mining, 1.3 percent in transportation and public utilities, and over 3 percent in agriculture.

As productivity rises, a corresponding expansion of output is required to maintain any given employment level. From 1957 to 1962, no industry division with a productivity gain averaging as much as 2.5 percent per year achieved enough increase in the demand for its products and services and hence in its production to prevent a reduction in its work force.

Broad conclusions from this statistical finding would be unwarranted at this point. In some years and some industries, production, employment, and productivity all move upward together. And within manufacturing, there is no consistent relationship between employment trends and productivity changes. The available evidence suggests, however, that in goods-producing industries and others of a basically mechanical nature, technological change has tended to be more rapid and extensive and to have a greater effect on productivity and employment than in most service industries, while the service-producing industries have been the ones with the most rapid increase in real gross product in recent years.

CAPITAL SPENDING AND RESEARCH AND DEVELOPMENT

New investment and capital stock

The magnitude and nature of recent capital spending and of the country's rapidly expanding research and development programs have influenced technological advances and the recent growth of productivity.

Expenditures for new plant and equipment mounted sharply in the United States during the immediate postwar decade. A peak was reached in 1957, when these expenditures totaled about $37 billion, compared with around $21 billion in 1947.[12] In the 2 years 1956 and 1957 alone, American manufacturers increased their capacity by about 10 percent.

Capital spending then fell rather sharply, because so much of the capital stock had been newly added or updated, and did not reach the 1957 figure again until 1962. In 1963 a new record of close to $39 billion was set. And the surveys of business plans for 1964 indicate that capital expenditures will be even higher this year than last.

The trends in capital spending between 1957 and 1962 explain the very moderate increase in capital stock per employed person achieved in these years. (See table 12.[12] The stock of capital equipment, the segment of capital stock most closely related to output per worker, rose at an annual average rate of only 1.3 percent from 1957 to 1962, not quite one-fourth the rate (5.4 percent) recorded for 1947–57, but the rate of increase in investment in plant per worker was only about 1 percent per year in both periods.

TABLE 12.—*Percent increase* [1] *in stock of fixed capital per employed person, 1947–62*

Period	Percent increase in value (constant dollars)		
	Total	Plant	Equipment
1947–62	2.6	1.3	4.4
1947–57	2.8	1.0	5.4
1957–62	1.1	1.0	1.3

[1] Computed by least squares method.

Source: U.S. Department of Commerce and U.S. Department of Labor.

[11] See p. 58.

[12] Figures on investment and capital stock in this section are in current prices and, except where otherwise indicated, are based on data from the Department of Commerce.

These overall figures give only a very partial indication, however, of the magnitude of the technological changes affecting workers. Between 1957 and 1962, the bulk of investment was devoted to modernization and replacement. This was true also in 1963 when roughly two-thirds of all capital spending by manufacturers went for replacement and modernization, with only one-third allocated to expansion of facilities.[13]

Expenditures for automated equipment have increased impressively. The proportion of manufacturers' capital spending allocated to automated machinery and equipment rose from roughly 11 to 12 percent in 1955 and 12 percent in 1959 to around 18 percent in 1962, according to a survey by the McGraw-Hill Co. in the fall of the latter year. Manufacturers also reported plans to devote a slightly higher proportion of their capital outlay to such equipment in 1963. The proportion of capital expenditures going for automated equipment was found to have risen significantly between 1955 and 1962 in all major branches of manufacturing except two—those in which the proportion was highest at the beginning of the period. The rubber industry devoted about one-fifth of its capital outlay to automation in each of the years for which figures were obtained. And in the motor vehicle industry, which was an early leader in automation, expenditures for this period dropped from about one-fourth of capital spending in 1955 to around one-fifth in 1962.

Although the proportion of capital expenditures devoted to automated equipment may not continue rising in the next few years, outlays for such equipment, as well as other technological improvements, will undoubtedly remain high. In fact, they may well increase further, in absolute if not relative terms, in view of the overall expansion in capital investment which is planned and the availability of many types of new equipment which offer the possibility of improved operations or products or cost savings.

Research and development

The sharp and persistent uptrend in the national expenditure for scientific and engineering research and development (R. & D.) also points toward continuing advances in technology and productivity. Measured in terms of current dollars the volume of research and development performed by private industry, the Federal Government, colleges and universities, and other institutions nearly tripled between 1953–54 and 1961–62, rising from slightly over $5 billion to nearly $15 billion. The National Science Foundation estimates that the cumulative outlay for research and development amounted to about $100 billion over the 1953–63 decade, and that it may double during the coming decade.

The number of scientists and engineers engaged in R. & D. work nearly doubled in the past decade and now stands at more than 450,000. Although private industry conducts about three-fourths of all R. & D. work performed in the country—the remainder being divided nearly equally between the Federal Government and all nonprofit organizations—it supports only one-third of the total expenditures on research and development.

In view of the great expansion in R. & D. activities, it may seem surprising that productivity and technological change have not proceeded at an even faster pace than is implied by the statistical measures available. It should be noted, however, that approximately two-thirds of all research performed in the country is financed by the Federal Government, and that the great bulk of this Government-sponsored research is directed to the needs of defense and space programs. Although Government-sponsored military and space research have made some contributions to our civilian economy, the timing and extent of their effects cannot be predicted with any degree of precision, depending primarily on the success of current programs to adapt advanced military technology to civilian uses.[14] Furthermore, much of the R. & D. work controlled and financed by industry itself is aimed at developing new or improved products, rather than improved processes. A survey by the McGraw-Hill Co. in 1962 shows that 47 percent of the reporting companies planned to concentrate R. & D. money on new-product research, 40 percent on improvement of present products, and only 13 percent on new-process research—the phase of research and development likely to have the greatest effect in increasing productivity.

New products have had, however, a significant effect on the growth of the economy. Many products now in demand did not exist 10 years ago. These

[13] "Preliminary Plans for Capital Spending in 1964–65," McGraw-Hill survey, October 1963.

[14] Some examples of contributions made to the civilian economy as a result of Government-sponsored research include wash-and-wear fabrics, mass production of penicillin, neon lights, the first successful electronic computer, and concentrated orange juice.

changes in demand are affecting the nature and distribution of employment—creating or expanding some industries, leading to declines in others. The extent of the occupational and geographic shifts in employment which can result is exemplified by the growth of the petroleum industry and the related decline in coal mining, and by the effect of the development of synthetic fibers in decreasing employment in cotton and woolen textiles.

The accelerated R. & D. expenditures made during World War II probably gave rise to a higher rate of productivity in the postwar period. But the greatest impact of our expanding R. & D. programs on productivity and civilian technology is possibly still to come. A stockpile of scientific knowledge and technical developments has certainly accumulated. The rate at which the most radical innovations will be introduced will depend, however, not only on the technological possibilities but also on many economic and social factors, including comparative costs, market prospects, and the availability of workers with the required technical backgrounds.

MAJOR TECHNOLOGICAL TRENDS

Automation and other technological changes currently underway in the United States involve a great number and variety of innovations affecting many industries and occupations. The following brief review of major technological trends is designed to indicate the nature of these trends and the fields of work chiefly affected by them, and also to suggest their diverse and sometimes offsetting consequences for employment and occupations.

Conclusions as to the extent and rate of diffusion of these changes have been possible in only a few cases. The reader should also bear in mind that, manifold as the changes are, there are broad areas of the economy—especially in the service-producing industries—which are at present only minimally affected.

Four of the broad technological trends or groupings of innovations here discussed—electronic data processing, instrumentation and control, numerical control, and advances in communication—are sometimes considered, in whole or in part, under the general heading of advances in information-handling technology. A second set of trends—improvements in machinery, mechanization of materials handling, developments in metal processing, and innovations in transportation and in power generation—continue the long-term trend toward substitution of physical energy for human labor in industrial activities. Finally, new materials and products are continuing to have an important economic and social impact on many industries.[15]

While each of these trends will be discussed separately, they have many important interrelationships. There is now a tendency to develop more and more combinations of innovations, which may have very far-reaching effects. An illustration is the prospective integration of advanced developments in three major fields—long-distance transmission of data, electronic computers, and materials-handling equipment. Through this linking of devices into one coordinated system, processing of customer orders, inventory control, and warehouse shipping will all be handled automatically. Orders will be transmitted directly to a computer which processes the inventory records and then signals the automatic materials-handling system in the appropriate warehouse to start moving the needed goods. Each of the three types of developments, used by itself, can have major economic and manpower effects. But when combined, their total impact on business organization, location of facilities, and manpower requirements will be expanded significantly.

Electronic computers

Electronic computers are unquestionably one of the most important innovations of the post-World War II period. With calculating speeds measured in millionths of a second, a vast capacity to store and retrieve information, and the ability to perform long series of instructions without human intervention, the computer is a highly versatile machine which is being applied to a constantly increasing variety of business, industrial, and scientific activities.

The computer was first introduced commercially in 1951. By mid-1963 the total number of general-purpose digital computer systems installed, according to one unofficial estimate, was about 12,000 and additional thousands were on order.

[15] As part of its research program on productivity and technological developments, the Bureau of Labor Statistics is preparing a report describing significant technological trends in 36 major industries, covering over one-half of nonfarm employment. The report is based on a summary review of trade and technical publications, annual corporate reports, Government studies, and some consultation with industry experts. Industry descriptions were reviewed by experts in each industry. The material in this section was derived, in part, from this report. For a brief discussion of technological developments in agriculture, which are not covered in this section, see the 1963 "Manpower Report of the President," pp. 73–74.

Undetermined, though smaller numbers, or special-purpose computers were also in use and on order. Annual sales value of electronic data processing machines and associated equipment estimated at about $750 million in 1963, was about 16 times the 1955 figure and more than double the 1959 amount.

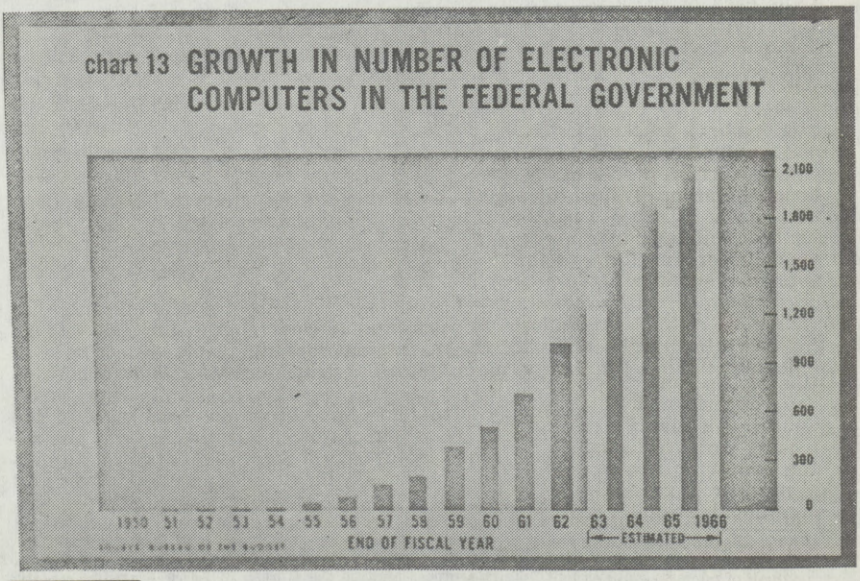
Improved models of computers are constantly being developed. In addition, their speed, versatility, and automaticity are being increased by advances in programing languages and in peripheral equipment, such as data communications devices, optical character recognition machines, and high speed printers.

Computers are now being used in all the major branches of manufacturing; many nonmanufacturing industries; and Federal, State, and local governments. There is, however, a heavy concentration of computers in a few major industries and in government agencies, chiefly Federal. As of late 1962 nearly half of all computers were being utilized by organizations in the following five categories: Government, transportation equipment manufacturing, electrical equipment manufacturing, insurance, and finance.[16]

A variety of economic, technological, and institutional factors underlie the present leadership of these industry groups in number of computers. In Government agencies, computers were introduced for scientific applications and for processing census data early in the last decade, and since the late 1950's have also been more and more widely used for many types of administrative and program operations. The insurance and finance industries are characterized by large-volume, routine paper-processing operations—a type of application well suited to processing by computer. In the electrical and transportation equipment manufacturing industries, the utilization of computers ranges from accounting to production control to scientific and engineering computations associated with the industries' extensive R. & D. programs. The extremely large companies in these manufacturing industries have had the necessary risk capital and technical knowledge to introduce computers early and are now extensive users of this equipment.

In a field influenced by so many uncertain factors, projections of future trends are inevitably shaky. There is general agreement, however, that use of computers will continue to grow rapidly.

Quantitative illustrations of the anticipated growth can be given for two fields. In the Federal Government, about 2,100 electronic computers are expected to be installed by June 30, 1966, as compared with 1,248 on June 30, 1963. (See chart 13.) And a survey of commercial banks made in March 1962 indicated that the number of such banks with computers would more than double within the next 3 years. (See table 13.)



[16] These estimated are based on a special report prepared by the Diebold Group, Inc., for the U.S. Department of Labor, Office of Manpower, Automation, and Training.

TABLE 13.—*Commercial banks with computer systems in operation or planned,*[1] *March 1962*

Use of computers in banks	Number	Percent
Total number of banks surveyed	972	100.0
Banks reporting or planning computer systems	382	39.3
In operation	116	11.9
In process [2]	62	6.4
Planned [3]	200	20.6
Unspecified	4	.4
Banks without computers or plans for them	590	60.7

[1] Covers commercial banks with total deposits of $25,000,000 or more.
[2] Includes banks in which computers are being installed and banks in the process of converting from one computer to another.
[3] Includes banks with computers on order and banks with definite plans to begin using computer systems within 3 years.

Source: Federal Reserve System.

Electronic data processing (EDP) has both employment-reducing and employment-generating effects. In business data processing, labor savings are chiefly in routine clerical work such as calculating, posting, filing and maining records, and in some office machine jobs such as tabulating and bookkeeping.[17] Computers also tend to reduce employment in certain types of factory jobs as a result of tighter production standards and inventory control. Requirements for lower and middle management employees may also be affected, because of centralization and coordination of decisionmaking and other organizational changes.

On the other hand, thousands of jobs have been created in new EDP occupations—e.g., those of programer, systems analyst, console operator, and tape librarian. Plants making computers have also expanded their employment. The availability of information-processing systems has caused many firms to introduce expanded reporting and control systems—leading, in some cases, to an increase in clerical employment. Numerous service centers, consultants, and other business services connected with the use of computers have come into being.

By facilitating research and development, computers are contributing to a flow of new products and even to the creation of new industries. Perhaps the most notable example is the aerospace industry, which uses computers intensively in the design and testing of new aircraft and space vehicles.

What the net effect of electronic data processing on employment is or will be on balance, cannot yet be determined. But one conclusion is already certain: major changes in occupational and industrial employment patterns are inevitable—with resulting needs for training in new and expanding fields of work and possible serious adjustment problems for large numbers of workers.

Instrumentation and automatic controls

The use of instruments of increasing complexity for measurement, sensing, data acquisition, and control is another rapidly developing area of technology. Sales of scientific and industrial instruments have been increasing by about 9 percent per year over the past decade, and were expected to total more than $5 billion in 1963.

Improvements in instrumentation—fostered by the space program and by other research in electronics, metallurgy, optics, and nuclear engineering, as well as by the large R. & D. programs of the instrument manufacturers—contribute to technological progress in many manufacturing, transportation, and other industries.

Systems of recording and control istruments have become a basic part of the design of plants where gases, fluids, and other chemicals are processed. Instruments not only measure and record such factors as pressure, temperature, humidity, and flow but also activate servomechanisms, which open and close valves and operate pumps under rigidly controlled conditions. A feature of some new processing plants is remote control of operations through centralization of instrument readings and manual controls.

[17] For studies on the impact of electronic data processing, see the Bureau of Labor Statistics reports: "Adjustments to the Introduction of Office Automation" (Bulletin No. 1276, 1960) and "Impact of Office Automation in the Internal Revenue Service" (Bulletin No. 1364, 1963).

Computers are being applied to process control so that complex computations based on the vast quantities of data supplied by the instruments can be made rapidly and accurately and the results fed back to guide the control instruments. It was estimated in early 1963 that about 237 plants in the United States—including petroleum refineries and electric power, chemical, steel, food, and cement plants—had already connected process control instruments to digital computers or were scheduled to do so.[18] While this advanced type of automation is still in an early stage of development, it has thus had considerable recent growth.

The progress of instrumentation and automatic control in industry affects in several ways the numbers and types of workers employed. The design and construction of complex instruments and related apparatus requires thousands of scientists, technicians, and production workers. Employment in the instrument and related products industry totaled 371,400 in 1963, slightly over 2 percent of manufacturing employment, but about 49 percent more than in 1950 (whereas in manufacturing as a whole, employment increased by only about 11 percent over this period).

The introduction of advanced instruments and computers for process control generally results in labor savings, by increasing production capacity significantly without a proportionate increase in the number of workers needed. The nature of the jobs held by operating, maintenance, and technical and supervisory workers is also likely to be affected. To handle the advanced control systems, some employees need long periods of training, which may involve courses given by equipment manufacturers as well as training on the job, though some maintenance can be done with little training. Large proportions of the employees in plants with such advanced systems are engaged in maintenance and repair of equipment, including the complex instrumentation, or in professional or other nonproduction jobs. In the petroleum refining industry, for example, which was a pioneer in the introduction of control instrumentation, the proportion of workers in nonproduction jobs has risen rapidly—from 23 to 37 percent between 1947 and 1962.

Numerical control

In the metalworking industries, more automatic production is being achieved through numerical control—a technique used to operate machine tools and certain other types of equipment by means of numerically coded information recorded in advance on punched cards, magnetic tape, or punched paper tape. Fed into a system of electronic interpreting devices, the information from the tape or cards can, with little human assistance, control a machine tool as it goes through a sequence of cutting operations. Once developed, the coded information—which is sometimes prepared with the help of a computer—can be stored for future use or used on another machine elsewhere to produce an identical part.

First commercially used in 1957, numerical control is still in an early stage of development and use. About 3,000 numerically controlled machine tools were estimated to have been installed by early 1963, but these represented only a tiny proportion of the total of about 2 million machine tools then in place.[19] Three-fourths of the new tools were in the aerospace and machine-tool producing industries, but there are at least a few in almost every maior metalworking industry. Some experts believe that within 5 or 6 years numerically controlled machine tools may represent 30 to 50 percent of all machine tools purchased.

One outstanding advantage of numerically controlled devices is their flexibility and applicability to small orders, which form a large proportion of total machine-shop work. In this respect, numerical control contrasts sharply with earlier types of automation in metalworking industries, which were devised for mass production. It thus has the effect of greatly extending the areas of metal-working susceptible to automation.

Already, numerical control is being applied to many types of operations in addition to metal-cutting machine tools. A beginning has been made in its application to wire winding, welding, drafting, and inspection, and its use is expected to be extended rapidly in these and other areas.

Where numericallycontrolled devices are installed, they can result in substantial labor savings in machining operations, the amount varying over a wide range with the design of the part, the quantity required, and the methods previously used. However, a new job category, that of parts programer, has to be added to work

[18] "Digital Computer Control List Lengthens, Market Matures" Control Engineering, vol. X, September 1963, pp. 73-83.

[19] "Numerical Control Shows Record Growth," American Machinist—Metal-Working Manufacturing, vol. 107, No. 15, July 22, 1963, pp. 71-76. This estimate was based on a survey of industries using these tools, and is somewhat higher than the number estimated by the Department of Commerce, which is based on the number shipped between 1954 and June 30, 1962.

out the coded instructions which are punched into the control tape or cards. Maintenance work is also increased, since the electronic circuitry, as well as the tool's mechanical structure, must now be serviced.

Advances in communication technology

In the field of communication technology, far-reaching achievements are greatly enlarging man's ability to overcome barriers of distance and time in transmitting and receiving information. The most spectacular is perhaps the communications satellite which, according to David Sarnoff, opens the way technically "for the establishment over the next few decades of a communication system by which governments, organizations, or individuals may establish contact with anyone, anywhere, at any time, by voice, sight, or document, separately or in combination."

Impressive improvements are also taking place in the scope, efficiency, and speed of existing communication systems. Expenditures on new plant and equipment in the communications industries amounted to about $3.6 billion in 1962, in 1962, an increase of 13 percent over 1961.

The telephone industry continues to make changes leading to more automatic operations as well as extended service. Approximately 50 percent of all long-distance calls in the Bell System are now customer dialed, and the figure is expected to reach 70 percent by 1970. Electronic switching will facilitate a wide variety of service changes. Data transmission, a rapidly expanding service, is expected to become an important adjunct of electronic data processing and other data processing activities in many industries, facilitating rapid distribution and utilization of data and centralized control of operations.

In television broadcasting, the impending opening of the ultrahigh frequency range to commercial use could make the establishment of many new stations commercially feasible. Other industries and sectors of the economy are making increased use of closed-circuit TV systems, for such purposes as monitoring hazardous industrial operations from a distance, facilitating business conferences without the physical presence of the participants, providing drive-in teller service in banks, and bringing outstanding educators to many different classrooms at the same time.

The new techniques of communication create opportunities to do things never before feasible, opening up areas for new investment and for employment growth, especially for engineers and other highly trained personnel involved in the design, manufacture, and utilization of electronic equipment. At the same time, greater automation of operations is tending to restrict employment per unit of output in many types of work. In the past, technological advances in this industry primarily affected operating employees, but a variety of new developments may also affect maintenance and installation workers. Through their cost-reducing effects, the innovations may also make possible price reductions which will tend to generate increased demand and thus have an expansive effect on employment.

Improvements in machinery

Extension of mechanization continues to be an important factor in increasing productivity in many industries. New models of automatic machinery—for presswork, bottling, packaging, and so forth—are constantly being introduced. The basic principles are usually unchanged, but through such advances as more powerful motors, heavier frames, simpler controls. and variable motor speeds the amount of labor required per unit of output is greatly reduced.

An important direction in machinery design is toward the integration of a number of hitherto separate steps into one large machine which carries through the series of operations with a minimum of intervention on the part of the machine tender. Thus, many automatic transfer lines have been built which integrate materials-handling equipment with a series of machine tools. Such transfer lines are used not only in the automobile industry but also in the mass production of a variety of other products, including electrical appliances, farm equipment, and office machinery.

Mechanization is also being extended to tasks still done largely by hand. The harvesting of fruit and vegetable crops, for example, may undergo revolutionary changes with the wide adoption of specialized labor-saving equipment. Machines for assembly work, one of the most difficult factory operations to mechanize, have been introduced by some large companies in the fabricated metal products, electrical and nonelectrical machinery, and transportation equipment industries.

Such improvements in machinery are designed to be cost saving, generally through a reduction in labor requirements per unit of output. If these cost savings are passed on to users, the effect may be an increase in demand. De-

pending on the consequent trend of output in the factory installing the new machines, they may lead to increased employment, worker displacement, or merely to changes in duties for the operatives affected. As a rule, requirements for skilled maintenance workers are increased to prevent costly downtime and speed repairs of the complex automatic machinery.

Mechanization of materials handling

The movement of materials, from the receipt of raw materials to the shipping of final products from the plant, is also being mechanized increasingly. Sales of materials-handling equipment are expected to amount to $1.4 billion in 1963, about 20 percent more than in 1961.

More powerful and maneuverable models of forklift trucks, hoists, cranes, conveyors, and tractors are being introduced in many industries, including construction, pulp and paper manufacturing, meatpacking, and foundries.[20] An innovation of growing importance in the handling of bulk materials is the use of pneumatic conveyors for moving granular materials by air pressure; this innovation has applicability to a variety of industries, including bakeries, cement, flour, fertilizer, and soap manufacturing, and longshoring. Through the combination of electronic devices with unmanned trucks or conveyors, warehousing operations are being mechanized—and in some cases highly automated—in large retail and wholesale companies, airfreight terminals, and other types of business organizations.

Substantial labor savings, primarily affecting unskilled labor, are made through the use of materials-handling equipment. If demand does not increase greatly, laboring jobs are replaced by relatively smaller numbers of operative positions, which may involve either operation or monitoring of the equipment, depending on the degree of automation. Since continuous operation of mechanized equipment is economically essential, requirements for skilled maintenance workers are once again increased.

New developments in metal processing

In the production of primary metals, cost-saving technological changes are now being stimulated by competition from foreign metal producers, and also from plastics and other materials which are being developed as possible substitutes for metals in more and more uses. The iron and steel and nonferrous metals industries have therefore expanded both their R. & D. programs and their capital investment in modernization of plant and equipment.

In blast furnaces, productivity is being increased by the use of beneficiated ore and by various improved practices. In steelmaking, a highly important development is the basic oxygen process, which produces steel six or more times faster than the open-hearth process. Oxygen injection is also being introduced into open-hearth furnaces, thus increasing their capacity at a fraction of the cost of constructing new furnaces. Table 14 shows the sharp rise in consumption of oxygen in iron and steelmaking. This increase is expected to continue, though possibly at a diminishing rate.

TABLE 14.—*Consumption of oxygen in the iron and steel industry, 1958–62*

Year	Millions of cubic feet in gaseous form	
	Blast furnaces	Steel-making
1958	5,876	13,049
1959	4,484	18,307
1960	4,362	29,219
1961	8,894	44,170
1962	11,411	54,675

Source: Annual Statistical Report, American Iron and Steel Institute, 1962.

Continuous casting is another potentially important development in the stee industry. Although this process has so far gained only limited acceptance by some big companies, it can make possible lower capital and operating costs than

[20] For a study on the impact of materials-handling innovations, see the Bureau of Labor Statistics report, "Impact of Technological Change and Automation in the Pulp and Paper Industry" (Bulletin No. 1347, 1962).

are required in conventional rolling-mill operations. In addition, increased instrumentation is being used to speed output and achieve greater precision and uniformity of product. All these technological advances are taking us close to the goal of complete automation of all iron- and steel-making processes.

The new metal-processing techniques generally have the effect of lowering both capital and labor requirements. As they come into increasing use, the demand for skilled maintenance workers may rise, although employment in the less skilled operative and laboring jobs, including materials handling, is likely to decrease. However, because continuous processing will undoubtedly reduce the marginal costs of production, it may stimulate the search for new markets and the expansion of established ones, thereby benefiting labor by reducing the frequency and duration of layoffs.

Technological advances in transportation

Under the spur of interindustry competition, the transportation industries are introducing a variety of cost-cutting innovations and service improvements. Rail, air, water, trucking, and pipeline industries are all undergoing substantial modernization.

In the railroad industry, new diesel-electric locomotives haul longer trains, at higher speeds and with greater loads, and have lower fuel and maintenance costs. Improvements in rolling stock are increasing the average capacity of box and tank cars. A recent development, the unitized coal train, competes successfully with a coal slurry pipeline. Centralized traffic control, electronic classification yards, improved signaling and communication systems all speed rail movement and afford more efficient use of facilities. And piggyback service, which combines the hauling capacity of the railroads with the flexibility of trucks, is growing rapidly.

In air transportation the conversion to jet aircraft is continuing. By 1970 practically all aircraft of scheduled airlines will be medium- and large-sized jets. Airports and terminals are also being modernized, and automation of air traffic control, baggage handling, ticketing and paperwork is increasing. Supersonic transports, with speeds of 1,500 to 2,000 miles per hour, are under intensive development.

In the trucking industry, engine improvements such as supercharged diesel and gasoline engines of 500 to 600 horsepower are imminent. The use of lighter weight metals and improved design in the construction of trucks could increase their capacity within legal weight limitations. In addition, highway improvements could permit larger and heavier trucks and higher average speeds, and reduce traffic delays.

In water transportation, the need for cost reduction to meet foreign competition creates pressure for automation and other technological improvements. A tanker with a 20,000-horsepower turboelectric engine controlled from the bridge is an example of an automated ship already in operation. Diesel propulsion, extensively used on foreign ships, has resulted in large fuel savings. Nuclear propulsion holds promise of further cost savings because its use eliminates bulky fuel and thus saves space for cargo. In addition, container ships are being developed which may substantially reduce loading costs and turnaround time.

Labor savings may be expected to result from the larger vehicle sizes and faster speeds anticipated in all forms of transportation. Additional labor savings could occur in freight handling, from growing use of containers and piggyback services; in maintenance, from mechanization and more reliable equipment; and in the business aspects of transportation, through greater use of computers and related devices.

Because of the possibility of worker displacement in the older transportation industries, especially the railroads, the retraining of operatives and maintenance workers is likely to be a matter of major importance. On the other hand, employment in air transportation and trucking will probably continue to grow, despite the anticipated technological advances and consequent increases in output per man-hour.

Technological advances in power production

Technical advances in the production and use of power, now underway or under development, can have a marked impact on the growth of the entire industrial system.

As the electric power industry expands to meet the rising demand for its output, it is increasing the capacity of the new generators installed and is introducing high degrees of automation in its generating and power distribution operations. Another important development is the trend toward coordination and interchange of electric power on a regional basis—a development expected to bring

about a substantial reduction in plant capacity requirements. Finally, the industry is emphasizing the development of extra-high voltage transmission. The transmission of large quantities of power over long distances—in some cases, from generating plants located at the mine head—could replace the shipment of coal to local utilities by rail and is frequently referred to as "coal by wire."

Developments affecting the sources of electric power are also in progress. Nuclear generators are expected to assume increasing economic importance in the late 1960's and thereafter, and a number of other possible sources of power are being investigated and tested. Magnetohydrodynamic (MHD) power—a method of generating electric power by passing extremely hot gases through a magnetic field—would eliminate the conventional, large, and costly turbogenerators. This innovation is still in an early stage of research. Work is in progress also on methods of producing electric power from chemical energy, radiation, heat, and sunlight. Because generators using these methods would be small and light in weight, consideration is being given to their possible use in remote areas, as well as in automobiles, trucks, and ships.

Major changes in methods of power production are expected to be introduced gradually, as such changes have been in the past. Cheaper, more accessible power could speed the progress of mechanization, and could also expand or reduce output for manufacturers of the various types of power equipment—with effects on employment in many fields of work. However, the growth of efficiency and output in the electric power industry in the postwar years has been accompanied by employment expansion, but at a much slower rate.

New materials and products

The development of new products and materials is an important and continuous feature of the country's technological progress. Some of these satisfy unmet needs or even generate new needs, thus expanding demand and employment. Others are essentially substitutes for existing products and so may adversely affect long-established firms and industries while helping others to grow.

The development of synthetic materials is one of the most significant achievements of chemical technology. From research laboratories have come a wide variety of manmade materials that compete with wood, steel, glass, paper, and leather, as well as cotton and wool. One of the newest synthetics, about to come into production, is a leatherlike material which could have a major effect on the leather, footwear, and meatpacking industries. Because of its uniform qualities, it could also facilitate the introduction of automated shoe machinery.

Another new plastic material—acetals—has the hardness, density, and strength of some metals. It can be machined and may replace metal components in many appliances and in automobile instrument panels. Plastic pipe is being used in some construction projects, and a substantial growth in the use of plastic materials for other construction purposes is foreseen by some experts. Reinforced plastics have been steadily replacing wood in small boats and other uses. And the flow of newly developed synthetics continues, sharpening competition with other synthetics as well as with natural materials.

Another important trend, stimulated by the competition from new materials, is toward improvements in older materials and the discovery of new uses for them. Thus, in recent years, aluminum cans are finding increasing uses because of their light weight and rust-free characteristics. The steel industry has fought back with "thin tin" for cans, much lighter and cheaper than standard tinplate. Other improvements in conventional materials include new glass ceramics, extremely hard and resistant to friction and high temperatures, for use in space technology; new finishes for fabrics to make them waterproof, oilproof, stainproof, and fireproof; and "engineered lumber" designed to meet specifications to widen the market and effect economies in construction.

The creation of new final products and components for them is an important objective of research and development in many industries. How far reaching the effects of a new product may be is illustrated by the transistor which, since its invention in 1948, has cut deeply into the market for vacuum tubes. In a recent period of only 4 years, 1958–62, production of transistors increased fivefold. Many new consumer products exploiting transistors are in development (e.g., electronic ovens, controls for locking windows and doors, and teaching machines).

The development of new materials and products can and does create new jobs. Employment in the production of semiconductors, for example, was estimated by the Department of Commerce at about 57,000 in 1962—more than double the number in 1958. The electronics industry has been a growth industry in recent

years; its estimated employment increased by over 200,000, or more than one-third, between 1958 and 1962.

Where new or changed products take the place of older ones, the creation of new jobs may be at least partly offset by elimination of work connected with the replaced products. On balance, however, product innovation is probably a strong influence in the direction of employment growth, though also causing industrial and occupational shifts in employment requirements and consequent displacement and readjustment problems for many workers.

SOME MANPOWER IMPLICATIONS OF TECHNOLOGICAL CHANGE

The rapid pace and pervasiveness of technological change in American industry are apparent from this brief review of major trends. The technological revolution continues to affect all segments of the economy, but some much more than others.

The factors which will stimulate or impede the extension of automation and other new developments, and the probable manpower consequences of these developments, are now being studied by the Department of Labor and many research organizations. At this point, conclusions as to the net effect of current technological trends on employment levels would be speculation. It is obvious, however, that important shifts in manpower requirements are in process, with forced readjustments for large numbers of workers and serious implications for the education and training both of the present work force and of young people still in school.

Occupational effects of several broad types can be discerned. These are briefly outlined below. It must be emphasized, however, that the conclusions indicated are provisional, subject to amplification and verification by further research.

Occupational changes

One of the most evident occupational effects of current technological changes is their impact on unskilled and semiskilled jobs. The increasing mechanization of materials handling has eliminated much manual labor in the lifting movement, and loading of goods. Factory jobs involving direct step-by-step manipulation of equipment or materials or manual tending of machinery are also becoming relatively fewer, because of the introduction of automatic machinery.

In some instances, the level of skill required to operate new machinery is no higher than that for the old operation. This is true, for example, of the men who feed, watch the operations of, and remove completed products from new automatic threading machines in a nut and bolt factory; and of those performing parallel functions on an automated line for the production of resistors in a new electronics plant. Occasionally the new job requires only that the person watch a light panel and push a button on signal.

But situations of this type do not negate the general finding that current technology is tending to restrict employment in jobs with low skill demands. While semiskilled operators are required for an automatic machine, they are likely to be few in number—far fewer than the operatives replaced by the machine. And in highly automated systems, where feeding of the machine and removal of products from it are handled mechanically, the manual aspects of operators' work may be eliminated altogether. On the other hand, a continued rise in the general level of income may mean more jobs for parking lot attendants, gardeners, hedgemen, and home repair mechanics, all of whom are relatively unskilled.

For production workers, the typical job of the future will probably be that of machine monitor. A good many operators of highly automated equipment already have this function. They may have responsibility for supervising complexes of automatic equipment (sometimes a battery of machines), for controlling an integrated system of conveyors and processing machines from a remote station, or for monitoring an elaborate instrument control panel and recording information for interpretation. More and more, the operator is becoming a skilled watchman, with functions demanding patience, alertness to malfunctioning, a sense of responsibility for costly equipment, and a better educational background than was needed in the past by factory operatives.

Maintenance and repair workers qualified to service and repair electronic equipment, instruments, and automated machinery have a growing field of employment. Plants that automate attempt to keep this costly equipment operating as nearly continuously as possible, thereby providing more employment for maintenance workers in most of the major areas of technological change discussed earlier in this chapter.

More and better training is required for the maintenance positions in enterprises adopting this new, complex equipment—especially because of the combination of electronic, electromechanical, and sometimes even hydraulic operations involved in the machine-and-control systems. Thus, many instrument repairment and business-machine servicemen need post-high-school education in engineering fundamentals, mechanics, or electronics, as well as intensive occupational training, to service the complex instruments and office machines coming into use. Maintenance electricians and appliance servicemen will need more technical education in order to handle a growing number and variety of electronic devices. Similarly, in some other skilled trades—including those of machinist, tool and diemaker, electroplater, and plumber and pipefitter—technological advances are introducing new technical requirements.

Among office workers, electronic data processing is eliminating many routine jobs and reducing the repetitive aspects of other jobs. Electronic data processing is having its greatest effects on detailed, repetitive manual work in functions such as accounting, addressing, billing, inventory control, payrolls, and other record-keeping. Many clerical occupations—especially those of a service character, such as bank teller, complaint clerk, receptionist, and secretary—continue unaffected by automation.

Most of the new EDP jobs, on the other hand, are at a higher level. Those of the programer and systems analyst are in the professional category, while most of the console and peripheral equipment operators are in the upper level of clerical work. Thus, considering both the jobs eliminated and those created, the net result of a changeover to electronic data processing is likely to be a somewhat higher average level for employees in the offices affected. There is evidence also that electronic data processing, in eliminating many of the routine elements of office jobs, enlarges employees' personal responsibility, requires greater accuracy in office work, and imposes the necessity for workers to meet more precise deadlines. Under some circumstances, the conditions of work for clerical employees under electronic data processing may become more similar to those of factory workers.

The evidence is still far from conclusive regarding the general effects of automation on managerial personnel. In some instances, however, the introduction of electronic data processing and the accompanying reorganization of managerial functions have led to reduced staffs in the lower and middle echelons of management.

In scientific and engineering professions, a notable effect of recent scientific and technological advances has been the creation of new specialties. Such fields as cryogenics, bionics, ultrasonics, computer technology, and microelectronics were little known a decade ago. The development of computers has also been one of the main factors in the great postwar expansion in the mathematics profession and has had a revolutionary effect in many other scientific and engineering fields. Interdisciplinary training of engineers and other professional workers and revision of engineering curriculums are proposed to meet industry's emerging needs.

Needed directions of action

The President's Advisory Committee on Labor-Management Policy, in its report on automation issued 2 years ago, outlined the many directions of action required to achieve maximum technological progress with minimum disadvantage to individuals. It recommended, among other measures, policies to promote a high rate of economic growth and full utilization of resources, collection and dissemination of information on changing job requirements, acceptance by management of responsibility for taking steps to lessen the impact of technological change on workers, retraining of displaced and potentially displaced workers through both government and private action, and a variety of other steps to protect and aid those displaced.[21]

This Committee, in response to a request from the President in early 1964, has undertaken a further study of the impact of automation and of what can be done to deal with the problems created. The Department of Labor is cooperating in this study. It is anticipated that it will provide new guidelines for policy and action.

In its program with respect to the manpower aspects of automation, the Department of Labor is following several major pathways—all related to the recommendations of the President's Committee in its 1962 report. Continuing research is in progress with respect to the current and prospective impact of technological

[21] "The Benefits and Problems Incident to Automation and Other Technological Advances," report from the President's Advisory Committee on Labor-Management Policy, January 1962.

advances on manpower requirements in different industries and occupations. Studies are also being made of the measures which have been used by employers and others in adjusting to technological change, of the effectiveness of these measures, and of the problems still in need of solution. And systematic efforts are underway to communicate the findings of this research on a nationwide basis, in order to generate public understanding of the nature and extent of the adjustment problems and of the needed action.

Through the State employment services affiliated with the U.S. Employment Service, the Department is assisting employers in the reassignment of potentially displaced workers. It is helping to find jobs for those laid off and is otherwise aiding in their readjustment. The employment service offices have also been conducting a series of automation demonstration projects to discover and demonstrate what these offices can and should do in labor markets characterized by unemployment and rapid technological change. These projects are intended to provide information about the effects of new technologies on occupations, make intensive individual services such as counseling and testing available to affected workers, and promote the adjustment of workers through training and retraining.

The training programs for unemployed and underemployed workers made possible by the Manpower Development and Training Act and the Area Redevelopment Act are another important avenue to worker readjustment. It is anticipated that training activities for displaced or potentially displaced workers will need to be expanded substantially, however, through both Government and private action.

With marked changes in employment requirements in process and in prospect across the occupational spectrum, American workers will have greater need for adaptability in the years ahead. All workers—whether engineers, administrators, laborers, or clerks—face the possibility of occupational changes necessitating retraining and readjustment.

The importance of broad education and training as preparation for work is underscored by this need for flexibility. It is further increased by the narrowing of opportunities in unskilled work and the trend toward greater knowledge and skill requirements evident in many occupations. If the Nation is to have the highly skilled, flexible work force demanded by our advancing technology, it is essential to strengthen the educational and training opportunities available to young people and to motivate them to take full advantage of these opportunities.

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Prepared Statement of Leon Greenberg, Assistant Commissioner for Productivity and Technological Developments

Productivity and Technological Trends in the Private Economy, 1947–62

In response to the request of the subcommittee, this paper presents some statistics of trends in productivity in the U.S. economy and some related data on technological change. The main points to be covered include (1) recent trends in productivity and how they compare with previous trends; (2) relationship of change in productivity to change in output; (3) analysis of trends for major sectors of the economy; (4) an illustrative statement of current technological developments.

In attempting to analyze and evaluate the trend of productivity, it is almost impossible to avoid controversy. Even those analysts who are trying to formulate objective judgments may come to different conclusions using the same body of information. In addition, productivity is caught up in the net of collective bargaining, where workers are concerned with income and job security and employers with costs and profits.

There can be reasons for differences in interpretation and evaluation. Various ratios of output to input can be computed and there is no single productivity index which answers any and all questions. Indexes may cover the economy, major sectors, or individual industries. Different time periods may be covered and may be affected by such factors as the business cycle and war production efforts. Even the word productivity is in some dispute, where some invariably define is as output per man-hour while others maintain that it must include captal as well as labor inputs.

There are, unfortunately, some statistical problems in measurement because the data are not always as precise as we would like them to be.

Despite these difficulties it is possible to develop a logical framework for analysis in terms of both industrial and time period coverage.

When evaluating productivity for technological impact on the labor force—on employment and unemployment—a useful ratio is output per worker or per man-

hour. This ratio helps in studying progress in manpower utilization and its corollary, labor requirements.

It is helpful to first examine the productivity of the entire private economy.[1] This total reflects the changes that have been going on among all the component industries as well as the shifts among these industries or sectors. For example, a shift of manpower from farms to factories can raise the productivity of the economy because the dollar value of output per man-hour; i.e., the level of productivity in manufacturing is higher than in agriculture.

So the measure for the total private economy is useful as an overall indicator of productivity change; that is, of the total change in output per person or per man-hour resulting from technology and other factors affecting the structure of the economy. But it is also necessary to examine the components of this measure in order to explain and understand some of the changes which have taken place. Moreover, the changes should be pinpointed, insofar as is feasible, to the particular industrial sectors in which they are occurring. Is the impact of technological change uniformly pervasive throughout the economy, is it randomly scattered, or is it concentrated in a few key spots?

Finally, it is important to examine recent trends, but a good deal of the evaluation must grow out of some understanding of cyclical or other "wave" influences and out of comparison with previous time periods.

Output per employee—Total private economy

In tracing the progress of productivity and the impact of technological change, it is usually preferable to work with the ratio output per man-hour. However, trends in employment and unemployment are most frequently described in terms of number of persons in the labor force. Therefore, as a starting point, it may be useful to indicate what has happened to output per employee (including the self-employed) based on labor force estimates.

Output per employed person in the private economy increased at an annual rate of 2.5 percent in the last 5 years (1957–62). This is slightly lower than the 2.7-percent rate of increase for the postwar period as a whole (1947–62). (Table 38 and chart 48.)

Output rose more than output per employee in 11 of the 15 postwar years and, of course, employment rose in those years. Employment declined when output per person rose faster than output. For the postwar period as a whole and for the last 5 years, on the average, output increased more than output per person and employment rose about 0.7 percent a year.

The output per employee figures are affected both by average hours per worker and by output per man-hour. The latter is a more useful measure for studying the impact of technological change and the rest of the discussion will be in those terms. For this purpose, man-hour information from the establishment surveys made by the Bureau of Labor Statistics will be used.[2]

Output per man-hour—Total private economy

Productivity (output per man-hour) in the private economy increased about 4 percent in 1962. This was a relatively large increase. However, large increases also occurred in other years. Small increases of 2 percent or less occurred in some years of the postwar period. Thus, productivity changes have not been uniformly distributed but have varied from year to year (chart 49 and table 43).

Because of these annual fluctuations, it is difficult, and perhaps misleading, to generalize or draw inferences about changes in trend on the basis of 1 or 2 years' experience. Exactly what period of time is best for measuring trends cannot be precisely determined, but it is not unreasonable to consider averages covering 5 years or more.

During the period 1957–62, output per man-hour in the private economy increased at an annual rate of 3 percent (table 39). If we go back to 1947, we find that the average increase for any consecutive 5-year period (e.g., 1956–61, 1955–60, 1947–52—there are 10 such periods) was 2.5 percent or more.

Moving back to cover a 10-year period, the average increase, 1952–62, was 2.8 percent. For the 15-year postwar period as a whole, output per man-hour increased at an average rate of 3 percent a year.

[1] General government is usually excluded because there is, as yet, no way of measuring the output of the public sector except as reflected by wages and salaries.

[2] These man-hours are based on employment and payroll data submitted by a large sample of employers. They are considered more reliable than man-hours from the labor force series. In addition, industry detail is available from the establishment series but not from the labor force series.

There are two other related pieces of information which can help put these averages in better perspective. One is the longrun rate of productivity change. The other is the relative change in output.

In the period 1909–47, output per man-hour of the private economy rose 2 percent a year. For the entire longrun period 1909–62, which of course reflects the influence of the postwar years, the average rate was 2.4 percent. Thus, productivity for the postwar period as a whole and for the last 5 years has increased at a more rapid rate than over the long run.

The longrun rate is also influenced by the decline in productivity which occurred in the early years of the depression. But it is difficult to find any long, sustained period with an average productivity gain as high as that of the 3 percent for the postwar period. In the decade 1919–29, when performance was relatively good, the average rate was about 2.9 percent. For the 15-year period 1930–45 the average increase was high, 3.4 percent. But this period starts at a depression low point and ends at a peak war year, so it is quite atypical.

With regard to the other point mentioned earlier, the relationship of productivity to output, it has been generally established that over short periods of time productivity changes are closely related to changes in output. During business cycle expansion, when output goes up rapidly, productivity also tends to increase rapidly. In the downturn, productivity may also decline or show a smaller increase.

For the postwar period as a whole, and for the last 5 years, output went up more than productivity. However, the differential between output and productivity was rather small. For example, in the period 1957–62, private output went up 3.3 percent while output per man-hour rose 3 percent per year.

In summary: Output per man-hour in the total private economy has moved up at an average rate of about 3 percent for the last 5 years. This is about the same as the postwar rate, and significantly higher than the longrun average. In the past 5 years output has exceeded productivity but by a small margin.

Output per man-hour in major sectors

The review of trends for the total private economy has been important for an overall view of the progress of productivity and its relationship to total output. However, as indicated earlier, the component sectors make varying contributions to the overall movements. What happens in these sectors may be important for an understanding of some of the employment implications of technological change.

Agriculture

A great deal has already been written about the great productivity performance of the agricultural sector. Agricultural output per man-hour improved very slowly (less than 1 percent a year) in the years between 1909 and the mid-1930's, then picked up speed and in the 15-year period since 1947 has averaged 5.8 percent per year (tables 39 and 40).

This sustained rise in agriculture is the result of several factors. One is improved technology, which has contributed via the use of farm machinery and the application of chemistry and biology to seed, soil, and insect pests. Also contributing has been the trend toward large-scale farming with its concomitant mass production techniques (as in chicken farming). A related factor has been the abandonment of small, less productive farms, and the decline in farm population, leaving fewer workers to till the land. Total agricultural man-hours have declined almost every year of the postwar period as productivity has exceeded output.

Annual changes in agricultural productivity tend to be much more volatile than those for the rest of the economy. They have ranged from a decline of nearly 5 percent (1949) to an increase of 19 percent (1948). The weather and its effect on crops is, of course, important on a year-to-year basis.

Because of the large annual fluctuations, changes in trend are not always easily discernible. Nevertheless, there does seem to have been a slowing down in the rate of productivity growth in this sector during the latter part of the postwar period. The average rate for the last 5 years was 4.7 percent, compared with 5.2 percent for the last 10 years and 5.8 percent for the last 15 (table 39).

Total nonagriculture

Productivity in the total nonagricultural sector has shown a postwar trend similar to that of the total private economy. It averaged a high rate of increase in the early postwar years, slackened off, and picked up in the last 5 years. The postwar average was 2.4 percent, the average for the last 5 years was 2.7 percent.

The postwar rate of increase has exceeded the longrun average, which was 1.9 percent for the period 1909–47. If the postwar period is added the longrun rate is 2.1 percent (tables 39 and 40).

Further analysis of this large sector is helped by examination of two major components—manufacturing and nonmanufacturing, where different movements have occurred.

Manufacturing

Some significant trends appear to be occurring in the manufacturing sector of the economy. Output per man-hour has gone up more than 4 percent a year in each of the years 1961 and 1962. The increase in 1961 was not unusual because it followed a year of low gain (2.1 percent). However, it is somewhat unusual to have 2 successive years of large increases.

Since some caution has to be observed in examining changes over a short span of time, we can extend the time period of analysis. In the last 5 years (1957–62) productivity increased at an average annual rate of 3.4 percent. This is about in line with the early part of the postwar period but substantially higher than the middle years spanning the period 1953–58. The average postwar rate was 2.7 percent (table 39 and chart 50).

We do not have data for comparison with long-term trends since these recent figures are based on man-hours of all employees in manufacturing—including the white-collar workers. Data for production workers—postwar and long term—will be discussed later.

Comparisons with output are also of some interest. Over the first 10 years of the postwar period, 1947–57, output went up substantially more than productivity—4.3 versus 2.8 percent—so there was a margin for expansion in employment. However, since 1957, the average increase in output barely exceeded the average gain in productivity (3.6 versus 3.4 percent), so the margin for increasing employment was very small.

The problem inherent in this comparison shows up more sharply if we calculate output per man-hour for production workers alone. Here, the average increase for the last 5 years was 4.1 percent, compared with an average productivity gain of about 3½ percent for the entire postwar period and with 3.1 percent for the long period 1909–47.

It should be pointed out that, in the decade 1919–29, output per man-hour of production workers increased at the high rate of 5.3 percent a year. But output increased at the same rate during that period, so there was no net decline in total hours of production-worker employment. In the past 5 years, however, output went up less than the productivity rate for production worker man-hours (3.6 versus 4.1 percent) and production-worker employment declined. In the first decade of the postwar period it was the other way around (4.3 versus 3.6 percent).

So, we seem to be experiencing high rates of productivity increases in manufacturing in the face of smaller gains in output. This implies a relatively higher impact of technological change or of other labor-saving factors in the manufacturing process. It also points up the problem of job opportunities for blue-collar workers. (The changing occupational-industrial mix will be covered by another Department of Labor witness. Industry trends within manufacturing will be discussed in a later section.)

Nonmanufacturing

In contrast to manufacturing, there do not appear to have been any significant developments in the rate of productivity change in the nonmanufacturing sector as a whole during the postwar period. The increase in the last 2 years has been higher than average, but not unusual compared with other years. The average annual increase for the last 5 years was 2.4 percent; for the postwar period it was 2.3 percent (table 39 and chart 50).

There has been some change, however, in the output-productivity relationship. Output has generally gone up more than productivity throughout the postwar period, but output has not gone up as fast in the last 5 years as in earlier years. In the period 1947–57, output went up at 4 percent a year compared with 2.3 percent for productivity; from 1957–62 the rates were 3.3 and 2.4 percent, respectively. Thus, there has been a declining margin of employment opportunity in the nonmanufacturing sector.

Productivity and employment

It is very difficult to pinpoint the cause and effect relationship between productivity and employment. There does not seem to be much question that in our

longrun economic history there has been a close relationship between productivity improvement and growth—growth of output, employment, income, and leisure time. In short-time periods, some establishments may have to meet competition by increased productivity and lower costs—in this sense, a further decline in employment of the particular plant may be prevented by its improved competitive position.

Quite often, in the short run, the process of productivity change is accompanied by sharp dislocation—by displacement of workers and the need to shift to other work, in different occupations, industries, or localities. In a maximum employment opportunity environment, the shifts may be accomplished easily. But if output is not increasing fast enough, if workers lack necessary education or skills, if discriminatory bars exist, if there are impediments to mobility, then long-term and high-level ratios of unemployment may arise.

Some attempts have been made to examine more intensively the relationship between productivity change and employment, at least on an industry basis. For example, Commissioner Ewan Clague and I presented an analysis of the productivity-employment relationship in a paper given before the American Assembly in 1962, where we showed this relationship for several hundred industries covering the periods 1947–57 and 1953–59. I would like to present a similar analysis, covering a later period. Before doing so, it is useful to establish a broader framework which may help in understanding the size of the problem.

If productivity is increasing at about 3 percent a year, and with about 60 million persons employed in the private economy (1n 1962), output has to expand sufficiently to provide 1.8 million additional jobs per year, otherwise unemployment will increase.[3] (In future years, as the labor force increases, the number of jobs required will also increase, even without any increase in the percentages.)

In the period 1957–62, output went up a little more than productivity. But this does not mean that there was no displacement. The annual figures show reverse ratios in some years, and the figures for the component sectors agriculture, manufacturing, and nonmanufacturing show even larger differentials of this kind. For example, as has already been pointed out, output increased less than output per man-hour of production workers in the period 1957–62, so few production workers were required.

A detailed analysis has been made of 200 industries in manufacturing, for the period 1957–61 (1962 data are not yet available).[4] (See table 41.)

To put the detailed figures in a proper setting, the following trends, 1957–61, are useful; output went up 7.8 percent and output per man-hour of production workers rose 17.7 percent. Thus, there was a decline of 8.4 percent or 1.1 million in production-worker employment. (There was no change in average annual hours paid for during this period.)

Was this decline of 1.1 million production workers associated with productivity gain or output decline? The detailed industry analysis shows the following (table 41).[5]

1. The decrease of 1.1 million was a net figure resulting from increased employment in some industries, lower employment in others.

Increase	229,000
Decrease	1,323,000
Net decrease	1,094,000

2. Of this total decrease, some was associated with declining output, some with productivity gain.

Associated with lower output	576,000
Associated with higher productivity	747,000
Total decrease	1,323,000

[3] In addition, jobs must be provided for new entrants to the labor force. The public sector is, of course, also a provider of jobs. It can be included in the calculations by lowering the productivity rate and raising the employment base.

[4] Some of the industry estimates may be subject to a high margin of error, but the cross-sectional analysis which has been prepared assumes that the errors are random, so no particular bias is introduced in the results. Separate estimates for the individual industries are not available for publication.

[5] Table 41 shows "unit man-hours" which can be related, arithmetically, to changes in employment. Productivity, or output per man-hour, is just the reverse of unit man-hours and is used in the text to maintain continuity of terminology.

These figures, reduced to an annual basis, indicate that the employment decline among manufacturing industries amounted to 331,000 production workers per year, of which 144,000 was associated with declining output and 187,000 was associated with increasing productivity.

The decreases in employment are not necessarily equivalent to layoffs—some workers retire, some leave voluntarily for other jobs. On the other hand, these represent industrywide figures over a 4-year span. More detailed compilations, on a plant-by-plant, year-by-year basis, would show additional job decreases, and job increases, and, therefore, indicate a greater degree of dislocation and job shifting.

Technological developments

The analysis thus far has dealt with trends which can be measured—output, employment, output per man-hour. While the last of these is an indicator of technological change, it is not a precise measure because changes may also be the result of other factors operating at the same time (scale of operation, the business cycle, management and worker skills, industrial relations, raw materials supply, etc.). In addition, some types of important technological change, particularly those reflected in new materials or new products, may not be directly reflected by a productivity index. They may, however, result in the decline of some industries and the growth of others. So it is not possible to measure in a precise way the impact of technological change. Often, description and qualitative evaluation are the best that can be done.

There are many technological changes taking place throughout the economy, and we must be careful to be neither overwhelmed by nor indifferent to their possible impact.

Many developments may affect only a small number of employers and workers. Change has occurred in past decades as well as in the present. In some cases an important technological breakthrough may be job creating rather than job displacing. And too often, new technologies provide the basis for gloomy feature stories, even though they are scarcely off the drawing board and are untried or untested.

Nevertheless, there are many important technological changes taking place which may have a serious impact on the number of workers required, on the kinds of skill and training they must acquire and on the need to shift from one industry to another, or from one geographic area to another. Such changes can result in severe hardship for many individual workers.

The Department of Labor is cognizant of the need for prevention as well as amelioration and has undertaken a number of pertinent programs under the Manpower Development and Training Act. In the Department's Bureau of Labor Statistics, our Office of Productivity and Technological Developments is orienting its automation research program toward a look at the future. We have several studies underway and on the basis of our preliminary research, it is possible to illustrate some of the technological developments that are taking place with examples from a few industries.

Bituminous coal mining

This industry has already experienced large increases in productivity accompanied by a drop in production and a sharp decline in employment.

Several developments are taking place which will probably maintain a high rate of productivity gain. These include automation of underground mining, increasing use of continuous mining machines, and other improvements in underground equipment and greater use of large-scale stripping equipment in surface mining.

Possible offsets to the productivity impact on labor requirements include cost-saving developments, such as Unitrain and the coal pipeline for transportation of coal, and research for new uses of coal and broadening of its markets.

Electric power

Output in this industry has increased in the last 5 years but there has been a slight decline in employment.

Technological developments which are already underway include the use of automatic dispatch systems, electronic data processing for office operations, the use of computers in powerplants, and the introduction of larger units in generating plants (which require fewer employees per unit of output). Electric power from nuclear reaction is not expected to be competitive with conventional power until the late 1960's. Other new sources, such as the fuel cell,

thermionic tube, thermoelectric generator, and solar cell, are still in very early stages of development.

Since production of electric power is expected to increase, it may balance off the labor-displacing aspects of technological change.

Electronics

Employment in this industry has increased fairly substantially in the last 5 years as output has increased.

Improvement is taking place in production techniques, which include semiautomatic equipment, mechanical (rather than manual) circuit board assembly, and other special equipment. Microelectronics; that is, the use of miniaturized electronic assemblies, is being developed and may be in great demand. This development may require more workers in fabrication relative to assembly. A great deal of research and development is also taking place in this industry.

The current technological environment plus defense needs are likely to result in continued expansion of this industry.

Insurance

Employment in this industry has expanded throughout the postwar period.

Large companies employing a large percentage of the industry's workers already have electronic computers. Future employment impact may arise from more efficient and more intensive applications. The use of reading devices could eventually reduce processing by keypunch operators. Faster communication systems between branch and agency offices and the central office could affect branch office labor requirements. Some marketing trends, such as direct selling and group coverage, may reduce needs for agents.

These changes suggest a tightening of job opportunities for routine clerical workers and for operators of conventional electric accounting machines. The extent to which this will occur will depend on the rate at which the insurance industry continues to expand its activities.

Pulp and paper industry

Output per man-hour in this industry has gone up more than the manufacturing average since 1957. Output has gone up a little less so employment has declined.

The spread between productivity and output may continue for the next few years because of further technological improvements. These include more widespread use of continuous pulping equipment, more extensive and elaborate instrumentation and automatic control, and improvement in materials handling.

Possible new uses for paper may expand markets and offset the effect of productivity growth on jobs. These new uses may involve paper coated with plastics, development of stretchable kraft paper and inexpensive paper substitutes for textile products.

Textile mill production

Output has increased since 1957 but employment has declined.

A number of technological developments could lead to reduced unit labor requirements. These include introduction of continuous automatic spinning which will affect such operators as picker tenders, card tenders, and spinning and winding operators. Higher speed textile machinery with larger packages, greater use of synthetic fibers which in some cases require less labor than natural fibers and automatic cleaning and handling devices are reducing manual labor requirements.

Possible offsets to lower unit labor requirements may arise from research and development in new uses and new kinds of textile fabrics, which would expand the potential market.

Steel

Output per man-hour in this industry has not gone up at a rapid rate in the last 5 years or so—it is less than the average for manufacturing, but because volume of output has not expanded there has been a decline in employment.

There are several important technological innovations taking place. Improved techniques in the preparation and processing of ore are expected to increase the productivity of blast furnaces. Continuing improvements in and increased use of the basic oxygen process are expected to increase productivity in steelmaking. Another new and major development is continuous casting, which can result in greater capital savings and lower operating costs. Instrumentation and automation in finishing mills are being steadily extended. Two factors which may hold down the rate of output are competition from other products,

such as other metals and plastics, and competition from other countries who are engaged in extensive research programs to improve their own steelmaking processes.

All these factors would suggest reduction in employment in this industry. The extent to which this reduction will be offset by increased output depends on developments in steel-using industries and the extent to which the steel industry, through its own research programs, will improve its competitive position with regard to other products.

Metalworking

Employment in metalworking industries has declined slightly in the last 5 years, all of it concentrated among production workers.

A number of important technological developments are taking place. One is the numerical control of machine tools which, thus far, has been used in only a few industries. But it is expected that a large percentage of new machine tools in the later 1960's will be numerically controlled. Automatic transfer lines are now being used in metalworking industries. There is improvement in materials handling equipment and automation of inspection operations.

Man-hour requirements for this industry will be affected not only by technology but also by the business cycle, foreign competition, Government defense needs, and developments in other industries.

TABLE 38.—*Average annual percent change*[1] *in output per person, output, and employment—Total private economy, selected periods, 1947–62*

Item	1947–62	1952–62	1957–62
Output per person	2.7	2.2	2.5
Output	3.4	2.9	3.3
Employment[2]	.7	.8	.7

[1] Computed from the least squares trend of the logarithms of the index numbers.
[2] Based primarily on labor force data. Includes self-employed and unpaid family workers in addition to wage and salary workers.

TABLE 39.—*Average annual percent change*[1] *in output per man-hour and related data, total private economy and major sectors, selected periods, 1947–62*[2]

Sector	Period		
	1947–62	1952–62	1957–62
Total private:			
Output per man-hour	3.0	2.8	3.0
Output	3.4	2.9	3.3
Man-hours	.4	.2	.3
Agriculture:			
Output per man-hour	5.8	5.2	4.7
Output	1.4	1.2	1.3
Man-hours	−4.1	−3.8	−3.2
Nonagriculture:			
Output per man-hour	2.4	2.3	2.7
Output	3.5	3.0	3.4
Man-hours	1.1	.7	.7
Manufacturing (all persons):			
Output per man-hour	2.7	2.7	3.4
Output	3.3	2.3	3.6
Man-hours	.6	−.3	.2
Manufacturing (production workers):			
Output per man-hour	3.6	3.6	4.1
Output	3.3	2.3	3.6
Man-hours	−.3	−1.2	−.4
Nonmanufacturing:			
Output per man-hour	2.3	2.3	2.4
Output	3.7	3.4	3.3
Man-hours	1.4	1.1	.9

[1] Computed from the least squares trend of the logarithms of the index numbers.
[2] Man-hours based primarily on establishment data. Includes man-hours of self-employed and unpaid family workers in addition to age and salary workers, unless otherwise indicated.

TABLE 40.—*Average annual percent change,[1] total private economy, agriculture, and nonagriculture, 1909–47 and 1909–62*

Sector	1909–47	1909–62
Total private:		
Output per man-hour	2.0	2.4
Output	2.7	2.9
Man-hours [2]	.7	.5
Agriculture:		
Output per man-hour	1.3	2.4
Output	.6	.9
Man-hours	−.7	−1.5
Nonagriculture:		
Output per man-hour	1.9	2.1
Output	2.9	3.1
Man-hours [2]	1.0	1.0

[1] Computed from the least squares trend of the logarithms of the index number.
[2] Based primarily on establishment data.

TABLE 41.—*Relationship between changes in employment and in unit man-hours for production workers,[1] manufacturing, 1957–61*

[Workers in thousands]

Type of industry	Number of industries	Production workers		Change in production workers		
		1957	1961	Total	Associated with unit man-hours	Associated with output
A. Industries with decrease in production workers:						
1. Decrease in unit man-hours equaled or exceeded decrease in employment	64	3,939	3,619	−320	−320	----------
2. Decrease in unit man-hours was less than decrease in employment	60	3,130	2,452	−678	−288	−390
3. Increase in unit man-hours	17	446	367	−79	----------	−79
Subtotal	141	7,515	6,438	−1,077	−608	−469
B. Industries with increase in production workers:						
1. Unit man-hours decreased	45	1,290	1,360	70	----------	----------
2. Unit man-hours increased	18	788	859	71	----------	----------
Subtotal	63	2,078	2,219	141	----------	----------
Total—Sample industries	204	9,593	8,657	−936	−608	−469
Total, all manufacturing	----------	12,842	11,748	−1,094	−747	−576
Decrease in employment [2]	----------	10,060	8,737	−1,323	−747	−576
Increase in employment [2]	----------	2,782	3,011	229	----------	----------

[1] Based on census employment data.
[2] Estimated from sample.

TABLE 42.—*Indexes of output per man-hour and related data, 1947–62 (man-hour estimates based primarily on establishment data)*

[1957–59=100]

Item	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Output per man-hour:																
Total private	70.9	73.4	75.5	80.9	82.9	84.7	88.2	89.8	93.8	93.9	97.2	99.6	103.2	105.2	108.7	112.9
Agriculture	50.2	59.6	56.8	64.7	64.0	69.9	77.8	83.4	86.4	88.3	94.2	103.0	102.8	109.3	115.8	119.7
Nonagricultural industries	76.3	77.9	80.8	85.1	86.5	87.6	90.0	91.4	95.3	94.9	97.6	99.4	103.0	104.6	107.6	111.7
Manufacturing:																
All persons	74.8	76.8	78.5	83.7	85.2	86.4	90.6	89.8	96.0	97.1	97.3	99.1	103.7	105.9	110.3	115.0
Production workers	67.8	70.3	73.4	77.3	79.1	81.4	85.6	86.9	92.1	94.2	96.0	100.3	103.8	107.3	113.0	117.3
Nonmanufacturing	76.8	78.2	82.1	85.6	86.8	87.9	89.0	92.0	94.6	93.4	97.6	99.8	102.6	104.0	106.7	110.1
Output: [1]																
Total private	68.4	71.2	70.8	77.3	82.0	84.4	88.6	87.2	95.0	97.0	98.9	97.0	104.1	106.8	108.6	115.3
Agriculture	81.2	92.8	88.0	92.8	87.0	90.4	93.7	97.6	102.9	100.5	99.0	100.5	100.0	104.8	104.3	105.3
Nonagricultural industries	67.7	70.0	69.8	76.4	81.7	84.1	88.3	86.6	94.5	96.8	98.9	96.8	104.3	106.9	108.8	115.9
Manufacturing	71.1	72.6	67.6	78.3	85.7	88.4	97.3	88.1	99.5	102.1	100.7	94.2	105.0	107.1	108.6	118.2
Nonmanufacturing	65.9	68.7	71.0	75.5	79.6	81.9	83.7	85.8	92.0	94.1	98.0	98.1	103.9	106.8	109.0	114.8
Employment:																
Total private	90.9	92.1	90.2	91.9	95.2	96.2	97.6	95.2	98.9	101.5	101.3	97.9	100.8	101.9	101.0	102.9
Agriculture	145.0	140.4	142.1	133.5	125.3	120.5	110.8	109.6	113.2	110.5	104.5	97.9	97.6	95.6	91.2	87.9
Nonagricultural industries	85.2	87.0	84.7	87.5	92.0	93.6	96.1	93.7	97.4	100.5	101.0	97.9	101.1	102.6	102.1	104.5
Manufacturing:																
All persons	93.8	94.0	87.2	92.0	98.9	100.4	105.8	98.4	101.8	103.9	103.5	96.2	100.3	101.2	98.4	101.6
Production workers	103.2	102.6	93.7	99.5	106.2	106.1	111.7	101.8	105.6	106.8	104.8	95.3	99.9	100.0	96.0	99.3
Nonmanufacturing	81.4	83.9	83.6	85.5	89.0	90.6	91.9	91.6	95.5	99.0	99.9	98.7	101.4	103.2	103.7	105.7
Man-hours:																
Total private	96.5	97.0	93.8	95.6	98.9	99.6	100.5	97.1	101.3	103.3	101.7	97.4	100.9	101.5	99.9	102.1
Agriculture	161.8	155.8	154.8	143.4	136.0	129.4	120.5	117.0	119.1	113.8	105.1	97.6	97.3	95.9	90.1	88.0
Nonagricultural industries	88.7	89.9	86.4	89.8	94.4	96.0	98.1	94.7	99.2	102.0	101.3	97.4	101.3	102.2	101.1	103.8
Manufacturing:																
All persons	95.1	94.5	86.1	93.5	100.6	102.3	107.4	98.1	103.6	105.2	103.5	95.1	101.3	101.1	98.5	102.8
Production workers	104.8	103.2	92.1	101.3	108.4	108.6	113.7	101.4	108.0	108.4	104.9	93.9	101.2	99.8	96.1	100.8
Nonmanufacturing	85.8	87.9	86.5	88.2	91.7	93.2	94.0	93.3	97.3	100.7	100.4	98.3	101.3	102.7	102.2	104.3

[1] Output refers to gross national product in 1954 dollars.

TABLE 43.—*Year-to-year percent change in output per man-hour,[1] total private economy and major sectors, 1947–62*

Period	Total private	Agriculture	Manufacturing	Nonmanufacturing
1947–48	3.5	18.7	2.7	1.8
1948–49	2.9	−4.7	2.2	5.0
1949–50	7.2	13.9	6.6	4.3
1950–51	2.5	−1.1	1.8	1.4
1951–52	2.2	9.2	1.4	1.3
1952–53	4.1	11.3	4.9	1.3
1953–54	1.8	7.2	−.9	3.4
1954–55	4.5	3.6	6.9	2.8
1955–56	.1	2.2	1.1	−1.3
1956–57	3.5	6.7	.2	4.5
1957–58	2.5	9.3	1.8	2.3
1958–59	3.6	−.2	4.6	2.8
1959–60	1.9	6.3	2.1	1.4
1960–61	3.3	5.9	4.2	2.6
1961–62	3.9	3.4	4.3	3.2

[1] Man-hour estimates based primarily on establishment data.

CHART 48.—INDEXES OF OUTPUT PER PERSON, TOTAL PRIVATE, AGRICULTURE, AND NONAGRICULTURE, 1947–62. EMPLOYMENT ESTIMATE BASED PRIMARILY ON LABOR FORCE DATA. (1947=100)

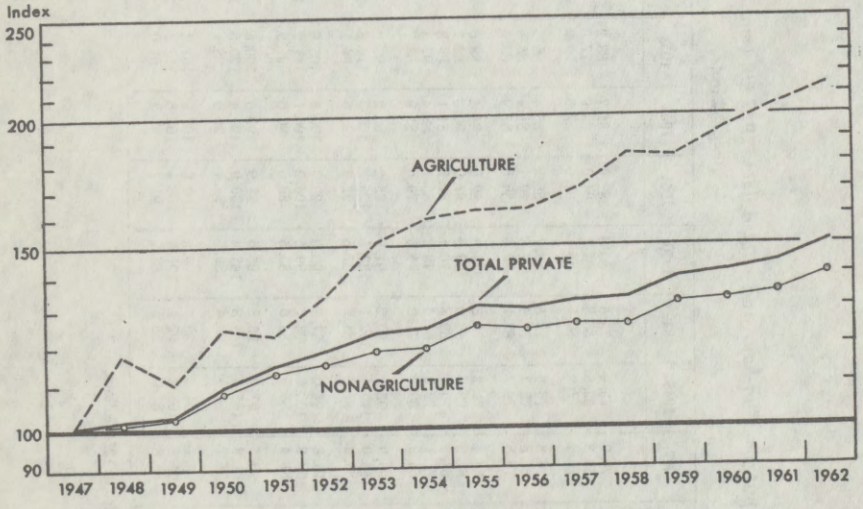

CHART 49.—INDEXES OF OUTPUT PER MAN-HOUR, TOTAL PRIVATE, AGRICULTURE, NONAGRICULTURE, 1947–62. MAN-HOUR ESTIMATES BASED PRIMARILY ON ESTABLISHMENT DATA. (1947=100)

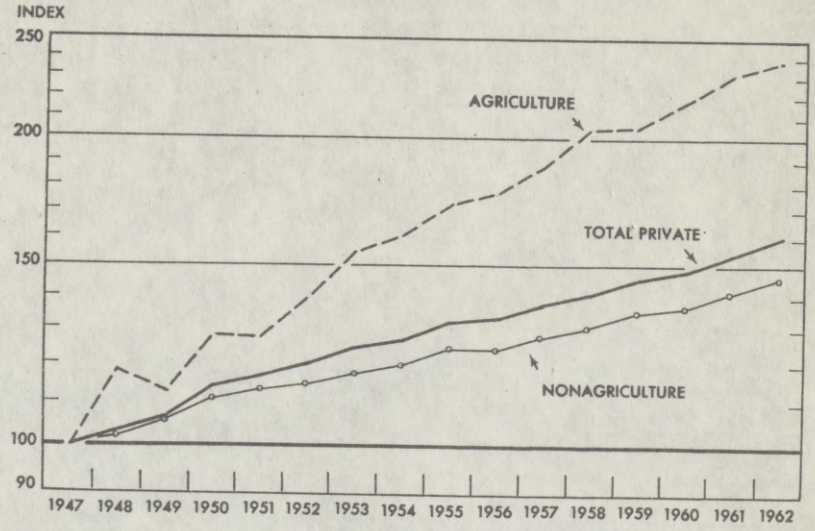

CHART 50.—INDEXES OF OUTPUT PER MAN-HOUR, MANUFACTURING AND NONMANUFACTURING SECTORS OF THE NONAGRICULTURAL ECONOMY, 1947–62. MAN-HOUR ESTIMATES BASED PRIMARILY ON ESTABLISHMENT DATA. (1947=100)